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A FIFTH JOURNEY IN PERSIA.*

By Major P. MOLESWORTH SYKES, C.M.G.

I.

In the autumn of 1902, after an absence of about two years, during which I had been able to compare the plateau of the Karroo with that of Irán, I reached Bandar Abbás, which port had already served as a starting point for previous journeys. There was a feeling of progress in the Persian gulf, mainly due to the impending inauguration of a quick service, which would bring Bushire to within about five, instead of eight, days of Karachi. Bandar Abbás was, however, not to enjoy the direct benefits of this boon; but three years later its isolation was terminated by the construction to it of a branch cable from the island of Henjám. "Better late than never" is a proverb particularly applicable to this step, and one can now hope that, in spite of its bad climate, the importance of this port will gradually be recognized by the various British firms who trade with Southern Persia.

We steamed slowly to the anchorage before dawn, and I was much struck by the imposing, if forbidding, nature of the scenery, and indeed Bandar Abbás is singularly favoured in this respect. In the foreground, some 3 miles distant, the Arab-like town stretched parallel to the sea-shore, backed by a wide expanse of "painted" desert, if we may apply the epithet used in America, behind which Kuh-i-Ginao and Kuh-i-Nián rise sheer to a height of some 7000 feet, and constitute gigantic portals to the caravan routes which ascend to the Irán plateau. Indeed, compared with Bushire, it may be said that Bandar Abbás is situated close to natural gates leading to Persia, whereas Bushire is

* Read at the Royal Geographical Society, June 18, 1906. Map, p. 429.

set down at the foot of a wall which has to be climbed by means of ladders. In due course of time geographical will overcome artificial advantages, and, unless I am mistaken, Bandar Abbás will ultimately become the chief port of Southern Persia.

Owing to the continuance of plague in India, we were quarantined near Naiband, a hamlet some 3 miles to the east of the port; but, thanks to the kindness of H.M.'s Consul, Major Grey, our discomfort was considerably alleviated. When released, we visited the governor in what was formerly the Dutch factory, but is now the custom house. It is interesting to know that Bandar Abbás occupies a site on or near the mediæval Suru or Shaheru, which, at the epoch when Hormuz was in the hands of the Portuguese, became celebrated as Gombrun, this word being a corruption of the word *gumruk*,* or custom house. In fact, the mediæval history of the Persian gulf reveals a constant change of ports. Under the Abbaside caliphs Siráf (now Táhiri), due south of Shiráz, was the chief emporium. In time it yielded its supremacy to the island of Keis, which, in its turn, was beaten in the struggle for commercial supremacy by Hormuz and Bandar Abbás.

For some years I had been anxious to travel over the section of country between Rudbár and the Persian gulf, which had, I believed, been traversed by the illustrious Venetian, Ser Marco Polo. Consequently there was no uncertainty as to the route to be pursued, and, after overcoming the usual transport difficulties, our party, which included my cousin, Mr. H. R. Sykes, whose photographs illustrate much of this paper, started off on the 300-mile journey to Kermán.

Four marches across the level plain and along the slopes of the Kuh-i-Nián brought us to what is now termed the Navargun pass, which, like all the low ranges near the Persian gulf—its altitude is but 1400 feet—proved somewhat difficult to negotiate, both from the badness of the track and the absence of water. There was also a fair chance of an attack from Bashákirdi raiders, who are now armed with Martinis, and are thus an unpleasant race to meet when lying in ambush in a narrow defile. That there is a fine historical continuity in their proceedings is proved by referring to Ser Marco, who wrote, "And then you come to another descent some 20 miles in length, where the road is very bad and full of peril, for there are many robbers and bad characters about." † On the eastern side of the Navargun pass, Rudán, which is a remote district of Fárs, had to be crossed. Its name has remained unchanged since the epoch of Ibn Haukal, who wrote in the fourth (tenth) century. Down its

* *Gumruk* is itself a corruption of the Greek *κουμερκί*. *Vide* 'The Lands of the Eastern Caliphate,' by Guy le Strange, p. 319. This is a work to which I am much indebted, and I have at the same time, by my travels, been able to contribute something to it.

† *Vide* Yule's 'Marco Polo' (3rd edit.), vol. 1, p. 107.

centre flows the Rudkhána-i-Duzdi, or "River of Theft," which is the principal tributary, if not the main stream, of the Mináb river; it is the Nahr-i-Zankan of Mukaddasi, who was a contemporary of Ibn Haukal. In 1898, on my journey across Bashákird, I had camped at Birinti, the village at which the junction of the two bodies of water is effected.*

After crossing the brackish river and the stony valley of Rudán, we reached the district of Rudbár, which forms a part of the Kermán province. Its Governor welcomed me at Gulashkird, the Lashkird of Ibn Haukal, and we rode up a charming gorge lined with date palms, down which ran one of the rare streams which are so highly prized in dried-up naked Irán. Indeed, for the last two years, dread drought, with its attendant, gaunt famine, had held sway in South-east Persia, so much so that the purchase of supplies of forage and food for our caravan was effected with the greatest difficulty. Moreover, owing to the drought, there was no game in Jiruft, and, one way or another, we were glad to hasten across the Jabal Báríz range, the passes of which might be blocked by snow at any moment. In short, as we were travelling at the coldest season of the year, and had much sickness and one death in the party, our arrival at Kermán in the middle of January, without being caught in a blizzard, was a matter of congratulation.

When I had left Kermán in 1900, the Church Missionary Society had but one representative in the shape of a clergyman; but when I returned, I found Dr. J. O. Summerhayes established in a small hospital, and engaged in performing a series of operations which formed the universal theme of conversation. Opinions differ as to missionary enterprise; but there cannot surely be two opinions as to the value of medical work which creates beneficent centres throughout the dark places of the world, and, incidentally, saves the lives of hundreds of Europeans. Apart from that, the hard-working, self-sacrificing life led by missionaries in Persia appeals to whatever is noble in the people with whom they are brought into contact, and, in the East at any rate, it is character which raises or lowers the prestige of the European, who is, and will ever remain, a numerically insignificant unit. Kermán had been suffering a good deal from the two years' drought, but this had fortunately coincided with a boom in carpets, which had materially assisted the prosperity of all classes. As a natural consequence, every one set up a loom, the weaving deteriorated, and a heavy slump ultimately set in, which was, perhaps, just as well from every point of view.

During the summer of 1903, I made a short tour southwards to the summer quarters of the Buchákchi† tribe, which consist of elevated

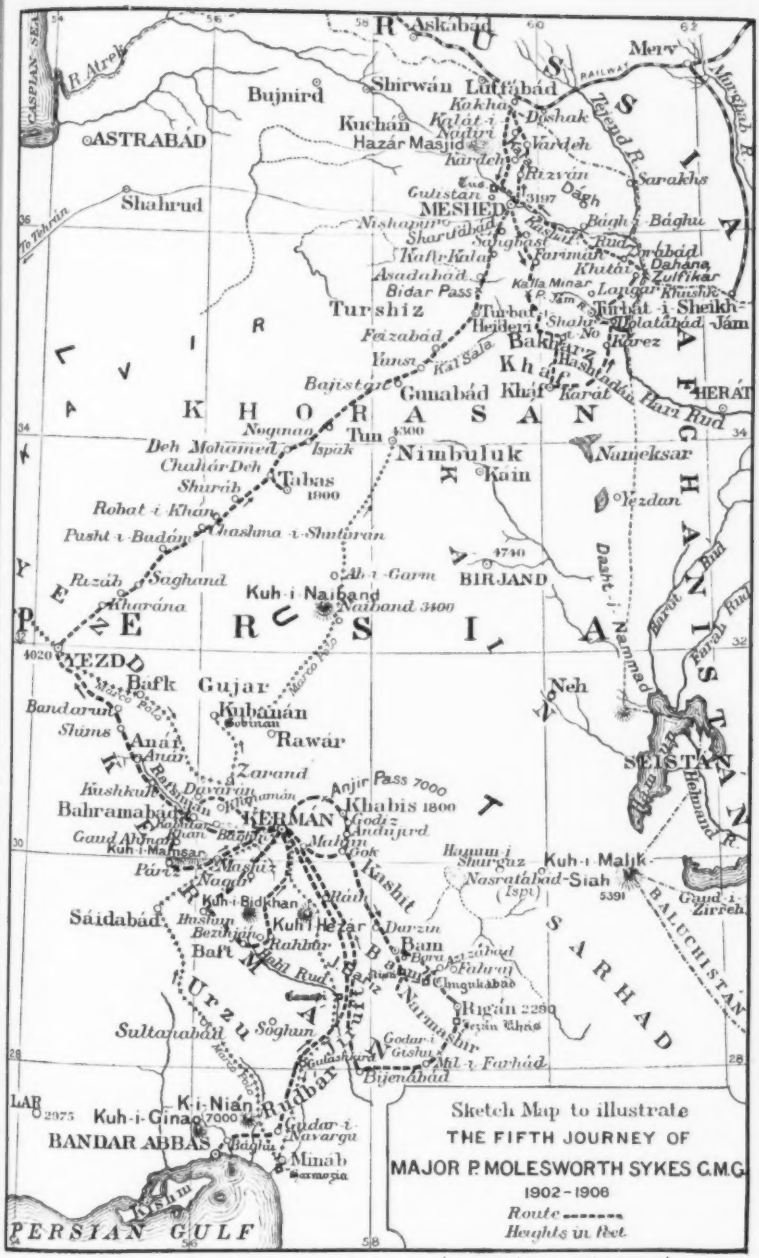
* *Vide Geo. Journal*, February, 1902.

† The Buchákchi tribe, with its three divisions of (*a*) Sarsaidali, (*b*) Kara Saidali, and (*c*) Khursali, is of Turkish origin, and is numerically weak, only aggregating 150 to 200 families.

rolling downs and charming valleys on both sides of the main range of Southern Persia, known in this section as Kuh-i-Bidkhán. Quitting their breezy uplands, we traversed the Afshár * country, where I was visited by its chief, Hasan Khan, who, in many ways, was a typical patriarch and one who loved the old order of things, when might was right. The old gentleman was full of complaints against the powers that be; but, as members of his tribe were generally the culprits in cases of raiding, one felt that, in this question as in many others, there was more than one point of view. The Afshár tribe is famous as having supplied a sovereign to Persia in the person of Nádir Sháh, who is referred to later on in this paper. Curiously enough, Khorasán, which was their headquarters, has been entirely deserted by the tribe which, while possessing important offshoots in the south of Persia, chiefly occupies the district between Kazvín and Zanján.

My meeting with the Afshár chief had taken place at the hamlet of Hushun, situated near the range of very low hills which divides the basin of the Halíl Rud from that of the great *Kavir*, or salt swamp of Persia, a term to which reference will again be made in this paper. From this point we swung due east to Báft and Bezinján, the latter district being the headquarters of the Lak tribe. The Lak claim our interest in that they are undoubtedly among the most ancient of Persian tribes. One of their divisions is termed "Zand," and they claim that the tribe was constituted the legal guardians of the Zoroastrian scriptures, which are commonly, but erroneously, known as the Zend-Avesta. A member of the Zand tribe ruled Persia after the death of Nádir Sháh, before the rise of the present dynasty. Indeed, but for the folly of his successors, the Zand dynasty, which Kerim Khan founded, might have continued paramount in Persia for many years. To-day the Lak are held, and not without reason, to be inferior to the average Persian. They are also said to be born thieves, whereas the Persian villager is extremely honest. So much so was this the case that, when the Persian guard of the Kermán Consulate was composed of men furnished by the Lak, they were invariably changed. It seems hard to give such a bad character to a tribe which can boast of such an ancient lineage; but, after all, the fact that they have been conquered by alien races tends to show that they furnish but yet another example of that decay which affects peoples as well as individuals. The whole country was in the throes of an invasion of locusts; but, owing to the abundant spring rains which had fallen, the crops were mercifully spared, and

* The Afshár tribe is also of Turkish extraction, and in the Kermán province alone there are 8000 to 10,000 families, the tribe being subdivided into seven subdivisions, viz. (1) Ali Ghazalu, (2) Kásimlu, (3) Jalálu, (4) Amui, (5) Pir Morádlu, (6) Ján Kuli Oshági, and (7) Fársi Madán. The headquarters of the tribe is the Kuh-i-Khabr. In summer they feed their flocks and till the land on its northern slopes, and in winter they move to its southern slopes.

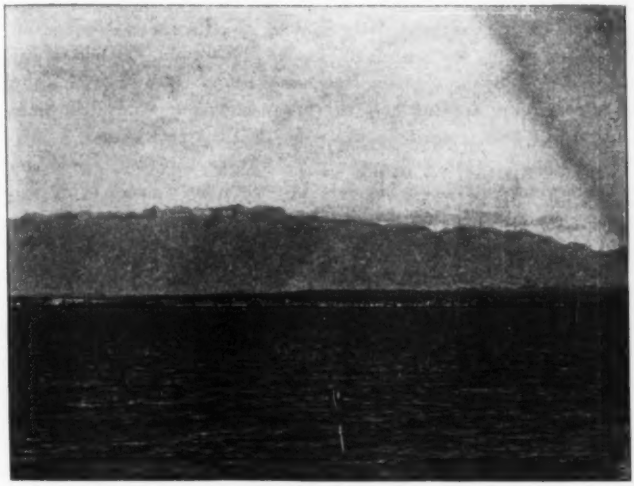

R. Askabad
Merv
Shirwán Luftábád
Bujnird
Kuchán
Hazár Masjid
ASTRABÁD
Shahrud
MESHED
Turshiz
Bidar Pass
Khaf
Bakharz
Kárez
HERÁT
Gunabád
Tun
Nimbuluk
Kain
Tabas
Nasseksar
Yezdan
BIRJAND
Kuh-i Naiband
Naiband
YEZDD
Bafk
Gujar
Kubbánán
Rawar
Anár
Zarand
Bahramabad
HERMAN
Khabis
Anjir Pass 7000
Sáidabád
Kuh-i Bidkhan
Kuh-i Hezar
Bam
Baft
Rigán
Sultanabád
Soghun
Kuh-i-Nián
Kuh-i-Ginao
BANDAR ABBAS
Minab
PERSIAN GULF
Neh
SEISTAN
Kuh-i Malik
Nasratábád-Siah
Gaud-i-Zirreh
BALUCHISTAN
SARHAD
Sketch Map to illustrate
THE FIFTH JOURNEY OF
MAJOR P. MOLESWORTH SYKES C.M.G.
1902-1906
Route -------
Heights in Feet
Scale 1:7,000,000 or 1 inch = 110·46 Stat. miles
50 0 50 100

the countless marauders contented themselves with stripping the bushes bare, and thus did but little harm to anything but the grazing. From Bezinján we skirted the Lalazár range as far as Rahbur, whence we turned due north and returned to Kermán before the hot weather finally settled in.

In the autumn Kermán was reached by the Central Persia telegraph line, about which I propose to give a few details. The main Indo-European line runs across Germany, Russia, and North-west Persia to Tehrán. Its onward course from the capital lay due south, and at Bushire cables had been laid down the Persian gulf to Jask. Thence one cable ran to Karachi *viâ* Gwádur; but there was also a land line which, more or less, followed the coast throughout the entire length of Makrán. So far as Persia is concerned, this alignment followed two sides of a triangle, and as cable transmission is slower and more expensive than a land line, it was decided to construct a new line, branching off at Kashán, and thence running *viâ* Yezd and Kermán to Bam. From Bam the Lut, the great desert of Persia, had to be crossed to India. Work was commenced at Kashán in December, 1902, and as far as Yezd, a distance of 237 miles, the rate of progress was 15 miles per week, which, in the Yezd-Kermán section of 220 miles, was increased to 20 miles per week. Kermán was reached in October, and by January, 1904, the line was completed as far as Bam. Here the three-wire section terminated, and, as there was much difficulty in selecting the most suitable alignment across the Lut, a single line was experimentally run between Bam and Kuh-i-Malik-Siá, the extreme north-west frontier of the Indian Empire. Two points, apart from the credit due to Mr. King Wood and his staff, are worth notice. The first is that the carriage of the material slightly exceeded its value; and, secondly, that Bandar Abbás handled more than one-half of the material, whereas the transport on the Bushire-Shiráz route broke down utterly under the strain. To conclude this necessarily brief sketch of a very difficult undertaking successfully carried through, the benefits of this line, from the point of view of the European communities in Yezd and Kermán, are great; but farther east, too, its advent will, I anticipate, prove of value in stimulating and protecting trade, as, owing to the fact that acts of brigandage or illegal seizure can be immediately reported, a telegraph line plays a considerable part in the pacification and development of any wild country which it may traverse, and this is particularly the case as regards Persia and Baluchistán. Indeed, it is not too much to expect that, thanks to its beneficial influence, the long-disused caravan routes between Southern Persia and India may be brought back to life. Baluchistán will also be a great gainer by the new state of affairs, and its inhabitants may possibly develop some commercial aptitude.

II.

In the spring of 1904 a short tour was made to the north-west and west of Kermán, the idea being to visit various parts of my district, which had hitherto escaped me. We first followed the Zarand road to the village of Zangiábád, which lies some 15 miles to the north-west of Kermán city. The whole district is termed *Kavír*, and certainly, as Marco Polo, who also followed this route, wrote, everything is very salt. Where the "Father of Geography" met with no water for three days, there are now villages fed by the underground irrigation channels, known as *kanáts;* but even so the water is brackish and unpleasant



BANDAR ABBÁS FROM THE SEA.

to drink. Indeed, the more one travels in Persia, the more one admires the patient industry which successfully overcomes the grudging hand of Dame Nature, who is here revealed in square miles of level salt-covered soil, on which nothing whatever grows of itself, but where man, nevertheless, manages to produce good crops of wheat, barley, and lucerne.

From Zangiábád we kept more to the west, and, the third day after quitting Kermán, rode into Kakh, the capital of Khinámán, which I had explored in 1900, and where the interesting bronzes referred to in the last paper which I had the honour to read before this Society were found. I had at that time been told of a bronze axehead identical with the one then given me, but surmounted by a lion and a grotesque

animal. My host, in the meanwhile, had recovered it from a servant who had stolen it, and I have much pleasure in exhibiting it to-night.

Leaving our camp at Kakh, we rode some 8 miles east to a secluded hill village known as Argus, which is said to be a corruption of Arjásp, king of Turán, who was the great enemy of the founder of Zoroastrianism. Its altitude was considerable, and from the top of the valley the eye scanned terrace after terrace of emerald-green crops. Below, in the dim distance, lay the yellow *Dakk*, as the level area between Bághín and Kabutar Kháu is called. This range is said to contain several deposits of coal; but although fuel costs fabulous prices at Kermán, I failed to induce any one to take the question up.

After saying good-bye to our hospitable host, the Khan of Khinámán, we travelled west along the edge of the hills to Dávarán, which lies some 20 miles due north of Bahramábád, on the Zarand route, and, the following morning, we examined one of the wonders of Kermán which I had heard of for many years, but had hitherto not been able to visit. This consists of a circular hole in the desert some 90 feet in diameter, closing to an oval-shaped fissure some 20 feet by 10 feet, which was unapproachable. Stones thrown in by us struck water, which must be of considerable volume, as camels are frequently carried away by it. Water is the first need of Persia, and it is to be hoped that this underground river, known as the Chah-i-Daria, or the "Well of the World," may some day be tapped to the great advantage of the district.

From this interesting phenomenon we rode down to the plain of Rafsinján, a district which I had previously traversed more than once. In mediæval times the whole of this valley as far west as Anár was termed Ar-Rudhán, the chief town of the district bearing the same name being at or near the modern Kushkuh, where there are extensive ruins. Bahrámábad, the capital of the modern district of Rafsinján, was the mediæval Unas, which was visited by Mukaddasi, and was famous for its fullers. To return to modern times, during the last decade there has been an extraordinary increase in the production of pistachios, which form the chief export of Rafsinján. Ten years ago these delicious nuts, which thrive best in salty land, and are grown on small and gnarled trees with a sage-green leaf, were produced to the extent of 120,000 lbs. only, but to-day the output is tenfold. The Rafsinján pistachios are possibly the best in the world, and it is well that there are some compensating advantages in the salt lands of Persia.

We spent three days with the Governor of Rafsinján, who was an old friend, and then travelled south to Páriz, up a valley thick with tamarisks, where, in the late autumn of the same year, we enjoyed excellent hare-shooting. Páriz is the centre of a small hill district bearing the same name, and dividing Rafsinján from Sirján, which latter district is as famous for its almonds as the former is for its pistachio nuts. The district occupies the rolling hills of the great

mountain barrier, and in spring and summer it forms a charming retreat from the heat of the plains, the former season revealing a wealth of blossom on a species of bush known as Badám-i-kuh, or "hill almond," which for once justifies the glowing panegyrics of Persian poets. Páriz has, however, the misfortune to be situated on the borders of Fars, and is thus much harried by robbers. One band of these gentry attacked my advance camp, but, receiving a warm welcome, speedily retired, and I espied them in the distance the next day, observing our party from the crest of a hill.

The speciality of Páriz is *gaz*, which merits a description if only for the fact that it is popularly identified with the manna of the Book of Exodus. *Gaz* is the usual name for the tamarisk, which is common in the stony watercourses of Persia. During the summer months a white sticky substance exudes from it, which is collected and cleaned, and, after mixing with flour, and sometimes with honey, is boiled with almonds or pistachios. The result is a delicious sweetmeat, resembling but excelling the best *nougat*. Chardin was, as far as I know, the first traveller to identify the above with the manna of Holy Writ. He describes the *gaz* near Isfahan, which is famous throughout Persia, as follows: "The leaves of this tree about Isfahan do in summer drop this liquid manna, which they pretend is not dew, but the sweat of the tree congealed upon the leaf." * Chardin refers to three sorts of manna, but subsequent travellers have apparently accepted the view that it is the exudation from the tamarisk. However, when I was studying the Koran, my teacher insisted on translating the word *mann*, or manna, by a word referring to a similar exudation from the camel thorn, which is still collected, more especially in the Turbat-i-Heideri district of Khorasán, and forms an object of export. *Turanjabin*, as it is termed, is a yellowish exudation, and is used by the Persian faculty for various diseases. If one reads the passages referring to manna in the Book of Exodus, and takes into consideration the nature of the country, which was then, as to-day, covered with scrub, it seems more reasonable to suppose that the substance was gathered from the bushes surrounding the camp than in the comparatively rare watercourses. Persians insist that *turanjabin* was the manna of Holy Writ, and, as far as I can judge, they are right.

The little town of Páriz must occupy one of the most elevated sites in Persia, situated as it is at an altitude of 7500 feet. Above it lies a carefully tilled valley, which is beautifully wooded with fine old walnuts, mulberries, and willows, and behind is the lofty range of Kuh-i-Mamsar. Quitting this charming little town, perched above the yellow plain of

* *Vide* 'The Travels of Sir John Chardin in Persia,' vol. 2, p. 35. Chardin mentions that "the best is of a yellowish colour, a large coarse grain, and comes from Nichapour, a country of Bactriana." This is undoubtedly a reference to the manna of the Turbat-i-Heideri district, which touches that of Nishapur.

Sirján, we skirted the Mamsar range in an easterly direction and joined the Sirján-Kermán route at Bid-i-Khab, where we were detained by heavy rain. When progress was again possible, we crossed the Khan-i-Surkh pass at an elevation of 8500 feet. Close by to the north is a remarkable jagged peak, which is visible for about 100 miles from the west. This pass was crossed by Gill, many years ago, in his journey across Persia, and, although thus not new ground, it was particularly interesting to me personally, as it was the only pass in the ranges to the south and west of Kermán which I had not examined. Like the Gudár-i-Kafanu to the south of Kermán, I found it extremely easy as regards gradients, although it is frequently blocked by snow in winter. Heavy hail-storms and bitter weather at the end of April made us glad to reach lower altitudes, and, after passing through Mashiz, which I have previously described, we returned to our headquarters almost simultaneously with the arrival of M. Alexander Miller, the distinguished Russian official who was commissioned to found an Imperial Russian Consulate at Kermán.

III.*

The summer of 1904 was mainly spent at Máhun, and I took advantage of the opportunity to examine in detail its famous shrine, which I have not previously described, but which deserves mention, from its historic interest, and still more on account of its architectural beauty. Indeed, outside the chief cities of Irán there is no shrine comparable to this artistic village tomb, which affords a striking example of the decorative value of ceramics in certain styles of architecture. Tiles are slowly but surely gaining favour at home too, and will, it is to be hoped, aid in dispelling somewhat of the unnecessarily dreary appearance of even the main streets of London, as every shower of rain helps to cleanse them from the grime which is so terrible an eyesore.

To return to our subject, *Seïid* Nur-u-Din, better known by his title of *Shah* Namat Ulla, was the son of Mir Abdulla of Aleppo, in which city he was born in A.H. 730 (1330). He was a descendant of the Imam Bákir, and in his extreme youth began a series of travels, visiting Kerbela, Mecca, and then Samarcand, where Tamerlane treated the saint with high distinction. Ahmad Shah, of the Bahmanid dynasty in the Deccan, also became one of the devoted followers of the spiritual *Shah*, who, after years of wandering, chose Máhun as a retreat for his old age. Many of the saint's prophecies are still current in Asia. One of these, to the effect that Christianity would rule for a century in India, and be succeeded by Islam, undoubtedly had something to do with the Indian mutiny; and a second prophecy, foreshadowing a great battle for the

* This part of the paper was read before the Geographical section of the British Association in 1906.

supremacy of Asia, which is to be fought on the Dasht-i-Bakwa, about halfway between Kandahár and Herát, is seriously believed throughout the Middle East, and is indeed remarkable if only for the site selected.

We were readily shown over the shrine, which is approached down the stony watercourse bisecting Mahun. This highway is arched over at a particular point, where the building on the left bank forms the residence of the *mutawali*, or "custodian," who is comfortably housed in the quarters erected for the use of pilgrims. On the right bank is the shrine, in front of which two gigantic plane-trees give that particular touch which, in conjunction with bright sunlight, shows tiles at their best. The main gateway is supported by two *minars* with a pre-

A TYPICAL MOUNTAIN TRACK.

dominating blue-green colour, which has a finer general effect than when inspected in detail. The oblong courtyard, which is first entered, together with the gateway, was erected by order of Mohamed Shah of Persia. His cypher appears in imitation Kufic lettering, and runs *Shah-in-Shah Anbiá Mohamed*, or "the King of Kings of the Prophets (was) Mohamed." The date is A.H. 1287 (1871).* A second courtyard, the gift of *Seiid* Nisa, an Indian disciple of the sage, is then traversed, and from it the actual shrine is entered. The blue dome is particularly fine when seen from this second court; indeed, the whole building, consisting of a central chamber supported by galleries, strikes one as

* Mohamed Shah himself died in A.H. 1250 (1834), but the work was carried out in his memory.

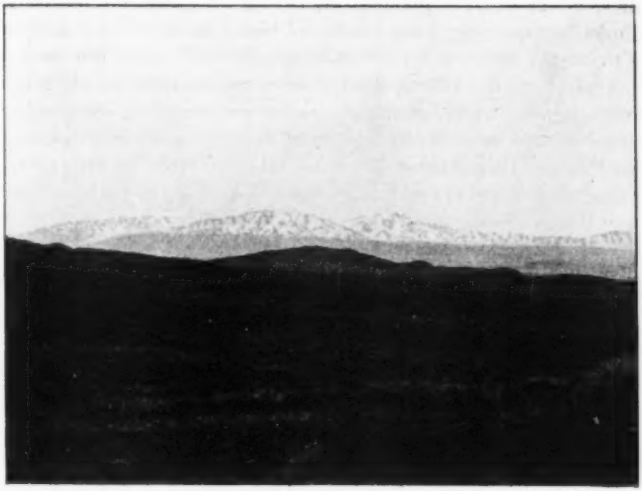
being remarkably well proportioned, and is eminently pleasing. The western gallery was constructed by Shah Abbás, and must have been gorgeous at the date of its completion, which, as an inscription over the entrance shows, was in A.H. 999 (1601). Even to-day the frescoes of flowers which survive are beautiful specimens of Persian art. The tomb of the saint is situated beneath the dome, and here we are in the original structure, which was erected by Ahmad Shah, of the Bahmanid dynasty. Again a date was forthcoming, A.H. 840 (1437) being clearly decipherable over the beautiful doors of sandal wood, which now, alas! are falling into hopeless decay.*

The actual tomb is of yellow marble very roughly fitted together, and the floor was, when I first visited the shrine, covered by a superb carpet with a pattern of fine dark brown medallions. The date woven in it was A.H. 1067 (1656), and this unique product of the Kermán looms was purchased for a few pounds by an enterprising Hungarian in 1895. The tomb of *Shah* Khalil Ulla, grandson of the saint, is to the south of the main tomb, and is surrounded by a yellow lattice. The eastern gallery opens on to a lovely courtyard, with a cruciform tank of limpid water containing an interior octagonal tank. As the date shows, both the gallery and two smaller minarets were completed, or more probably restored, in A.H. 1287 (1871) by the Vakil-ul-Mulk, at that time governor-general of the province, who forced the then *Mutawali* to provide the funds. So much for the shrine itself, but its interest does not cease at this point, as in it was deposited the single relic of Achæmenian times which existed in South-east Persia. This was a small pyramid some 6 inches in height, with a tetragonal base, black in colour, and probably carved from a block of limestone. One side was blank, but on the other three was a finely cut inscription in Persian, Assyrian, and the language of Susa, which ran as follows: "I Darius, the Great King, King of Kings, the King of the Countries, King of this land, son of Hystaspes, the Achæmenian." I had heard of the existence of this little pyramid from reading Gobineau's work, but no one seemed to know anything about it at Mahun, and so the matter dropped. My Russian colleague was, however, more successful, and was able to obtain photographs of this interesting stone. But, alas! his success was fatal in one respect, as news of its existence reached Tehrán, whence peremptory orders were telegraphed for it to be sent to H.I.M. the Shah. My latest information on the subject of this Achæmenian relic is that it never reached Tehrán, but disappeared between Kermán and the capital. It is, consequently, most fortunate that it has been both photographed and deciphered before perhaps being lost for good. I understand that magical healing powers were attributed to this little block of stone, and that it was applied to the

* Ahmad Shah ascended the throne in A.H. 825 (1422), and died in A.H. 838 (1435).

bodies of sick persons suffering from any and all diseases with wonderful effect. To conclude this brief description, after repeated visits to the shrine, it possesses a charm for me which is perhaps due to the combination of tiles, greenery, and running water, glorified by the turquoise blue of the Persian sky, which I have never seen equalled elsewhere, and whenever I reflect on an ideal scene in Persia, my thoughts invariably revert to Máhun.

The event of the winter of 1904–5 was the arrival in South-eastern Persia of a commercial mission under Mr. A. Gleadowe Newcomen, which landed at Bandar Abbás in October, 1904. I met their camp at Sirján, and conducted the party *viâ* Páríz and Bahramábád to Kermán, where inquiries were made which kept us fully occupied until the end



THE LALAZÁR RANGE FROM THE SOUTH.

of 1904. At the same time preparations were being made for a mid-winter journey, much of the success of which depends on the adequacy of arrangements to meet all likely contingencies.

It was January, 1905, when the mission started off on the second section of its journey, the immediate objective of which was Khabís, and as I had never visited the Kermán "Riviera," I looked forward to the journey with much interest. The first stage lay almost due east, the stony track running up to the watershed which divides the Kermán basin from that of Khabís. From the top of this pass we looked down a steep and stony valley to the maze of ranges ahead, and as we were at an elevation of over 7000 feet, we rejoiced to find that rooms in a

dilapidated house had been secured for us at the stage of Darakht-i-Anjirá. The following morning we were up some hours before daylight, as the march was both long and trying, and, starting in intense cold, we entered a grim and gloomy defile shut in by beetling cliffs which towered thousands of feet above. When dawn, that wizard of the East, lightly touched the peaks while we pursued our way in gloom below, it was almost impossible to exaggerate the beauty of the delicate shading laid on these old-time cliffs, which were more especially impressive after our late experience of rolling hills and wide open valleys. This phase of our stage abruptly ended as the track turned up a side valley, crossed a rough neck, and again descended to a second valley, which was full of the ever green oleander, the bane of all four-footed beasts, not excepting the indomitable ass. We lunched at the junction of two streams, under gnarled plane trees, at Dar-i-Sakhti, or the "Gate of Hardness," a most appropriate name, and tasted water which is generally held to be the finest and lightest in the province. But the pass was still ahead of us, and after a short rest we resumed the march, turning up another valley which grew narrower as we proceeded. Suddenly we heard a confused noise to our right, and to our surprise saw the almost perpendicular hillside thronged with donkeys, albeit so distant were they that we thought at first that we were looking up at a flock of sheep. Riding being almost out of the question, we slowly walked up the tortuous track, and were met by caravans of donkeys laden with golden oranges, all painfully stumbling down the precipitous mountain pass on their way to Kermán. At last the summit was reached, when, from an altitude of 7000 feet, we enjoyed a superb view across a succession of rugged spurs down to the illimitable Lut, which, in appearance, resembled rolling ocean waves, but which, instead of uniting, ever divides. Before sunset we were clear of the hills, and encamped near the first palm grove of the plain. But it was long into the night before our mules with the indispensable bedding arrived, and their advent filled us all with joy, as, after a march of fourteen hours, one of the hardest stages in Persia had been successfully accomplished.

Khabís, the following day, lay but a few miles distant, and recalled the epithets bestowed on Damascus, although, perhaps, the blighting Lut should make the traveller approaching its date groves from the east even more appreciative than the Arab who gazes with rapture on the "Eye of the Desert." The day was exceptionally clear, so much so that I was able to recognize a sharp-cut peak, known as Shah Kuh, which I had observed when skirting the eastern margin of the desert some five years previously, and which must have been nearly 200 miles distant from Khabís. We were met by the governor and principal residents a few miles out of the town, and were warmly welcomed, as Khabís is so close to Kermán that I knew practically every one of importance. In blinding dust we rode through narrow lanes

between high walls, and finally found our camp pitched in a lovely grove of oranges and palms.

Khabís, situated at an elevation of 1800 feet, derives its name from an Arabic word signifying a sweetmeat composed of dates, flour, and clarified butter, and possesses a population of perhaps five thousand inhabitants during the winter months, and less than two thousand during the summer. As is so often the case, little is known of its past history, but its antiquity is attested by Ibn Haukal, who described it as "a town on the borders of the desert, with running water and date trees;" other writers refer to it as being populous and an important

RUINS OF SUPPOSED NESTORIAN CONVENT AT KHABÍS.

silk centre, its gardens being celebrated for their mulberry trees. There are also references to the district in Seljuk times, and, until the Kájár dynasty was firmly established, it was held by Afghans, whose descendants still own much of the land. Dates are, of course, its staple product, the output averaging 3,000,000 lbs. annually, 70 per cent. of which is carried across the Lut to Khorasán and distant Herat. But the famous oranges of Khabís, the golden fruit of the Hesperides, delight the English traveller still more than the dates. The parent stock is the *bakrai*, which produced a yellow, somewhat insipid orange. On this is budded the *naringi*, or loose-skinned orange, the lime, and the Seville orange, and also the "Portugale," * or orange generally sold in

* This is, as far as I know, the only trace the Portuguese have left in the language of their long connection with Persia. Cf. modern Greek, πορτοκαλί.

Europe; this latter is, however, somewhat scarce. In any case, Kermán owes much to the oranges of Khabís, which are, indeed, transported to Tehrán, specially packed in cotton for the use of the royal table.

The morning after our arrival, we rode out to the east of the oasis to examine the site of an ancient Khabís. Until eighty to one hundred years ago, the entire population was crowded into an enclosure covering some 50 to 70 acres, and surrounded by a bank and strong towered wall, which could doubtless tell many a tale of Afghan and Baluch foray. Outside are the ruins of various buildings, one of which is known as *nakus*, or *akus*, signifying a rattle, which implement was employed by Christians instead of a bell in Mohammedan countries to summon the faithful to prayers. The chief portion now extant is an octagonal brick tower some 30 feet in height. Inside it are tombs,* the stones of which have been carried off and used as facings to water-channels, and the *mihráb*, or place of prayer, is set towards Jerusalem, and not towards Mecca. The kiln-burnt bricks are not of the size or colour now employed, nor have I seen an octagonal tower anywhere else in Persia except at Burj-i-Aga-Mohamed, in Narmashir. Indeed, it is difficult to dismiss the tradition that this was a Christian convent, when we take into consideration both the name of the place and the orientation of the *mihráb*; and, finally, the tower bears a vague family likeness to illustrations of churches in Armenia, which I have seen. I prefer, however, to leave the decision on this knotty point to a more competent archæologist than myself, noting, however, that the Nestorians firmly established themselves in Persia, and that, in the fifth century A.D., there was a Nestorian bishop of Kermán. But it is for the superb view that I shall ever remember Khabís—set on the brink of the tawny Lut, and displaying the rich colourings of its orange and date groves under a cloudless blue sky, the whole picture being backed by the dazzling snows of the mighty range which rises almost sheer to a height exceeding 13,000 feet, and perhaps once set the limits to an inland sea.

From Khabís we had intended to march due south to Bam *viâ* Kashít, the Kashíd of Mukaddasi, and thus keep in the *Garmsír*, or Hot Country; but the question of supplies was paramount, and, in consequence, we were compelled to make for the large village of Gok, situated in an elevated valley parallel to that of Máhun. It is a district where we might expect intense cold, which is so dangerous for natives of India, of whom we had many in our party. Upon clearing the oasis, we marched east-south-east across an utterly arid plain, passing ruins which are said to be all that is left of a Khabís more ancient than the one described. We then swung south and made for the low hills, among which the hamlet of Godiz lay concealed. Behind it we sighted the

* One of these tombs bore the date A.H. 173 (789).

ruined watch-towers and fort of Andujírd, which is a charming oasis set in a framework of naked sterility, with a gleaming background of salt. Andujírd is an ancient site, and we discovered a tombstone bearing the date A.H. 800 (1397); it is famous for its oranges, which excel those of Khabís. The following morning we entered a maze of deep ravines, some of which, from their sullen gloom, reminded me of Doré's illustrations to Dante's 'Inferno.' In time, however, we rose to the uplands once again, and after a trying march, which included a rise of some 4000 feet, reached the little town of Gok, the Kuk of Mukaddasi. Although it was January and we were in tents at an elevation of about 7000 feet, the weather was comparatively mild, and the musk willow, the earliest of trees in Persia, was out in premature bloom.

We halted a day at Gok, which is famous for its grapes, to allow our advance camp a long start on the route to Tahrud, which was 40 miles distant, the intervening country being absolutely waterless. Fortunately, our loads were light, as otherwise the whole expedition might have broken down, mules being unable to march such a long distance without water when it is hot. We left Gok in the dark, and stumbled down a stony watercourse for some time, until, 7 miles out, the going became good, and we pressed on hour after hour. About 2 p.m. we arrived at the crest of the pass overlooking the Tahrud valley, and by sunset reached our camp, which was only just in, and, as may be imagined, we found man and beast worn out after a march of over thirty hours. The chief anxiety was, however, the fate of the few mules which had been left to follow us with specially light loads; and when they arrived safely late at night one felt most thankful, as a storm in such an elevated district would have been fatal to any weak members of the party.

Bam was reached a few days later *viâ* Darzín, and then the winter set in with extraordinary severity—so much so that, as we afterwards heard, the orange groves of Khabís, of Tabas, and of Mazanderán were all ruined. I have already described Bam as being the most easterly town in South-east Persia and some 700 miles from Quetta, the first town on the British side of the frontier, the entire intervening space being desert. It is situated at an altitude of 3600 feet, and the prosperity of its 13,000 inhabitants mainly depends on the henna of Narmashír. In a *Bam Náma*, or 'Chronicle of Bam,' written about three centuries ago, the *Arba* or "four" cities of Bam are referred to as Darzín, Nisá, Chugukabád, and Jezán Khás. Darzín of to-day is surrounded by ruins and choked *kanáts*, but in the twelfth century of our era formed the theme of a glowing eulogy.* It is situated a stage to the north-west of Bam, as mentioned above. The other three

* Cf. 'Ten Thousand Miles in Persia,' p. 215 *et seq.*, for a description of Darzín and Bam.

cities were in the district of Narmashír, which I had previously traversed in two directions. I had, however, been unable to quit the beaten track, and consequently I was delighted to have the opportunity of exploring these interesting sites at leisure.

The oasis of Narmashír—the Arabs termed it Narmasir—lies to the south-east of Bam, and is especially important from the fact that the main route from Bandar Abbás to Seistán and Khorasán runs across it. When South-east Persia was subdued by the Arabs in the seventh century A.D., its hot climate evidently attracted them, and, so far as can be ascertained, Nisá was their headquarters. Our first stage from Bam lay to the south-east, and soon after entering the Narmashír district, we found the ruins of this Arab city, which are even now most imposing. Its fort, occupying the south-west corner, possessed walls 70 feet in height, which is most unusual in Persia; along the top a gallery ran round the wall inside. We camped at Kuruk, 3 miles to the south-east of the once famous Nisa, and thence rode into the hills to examine the *band*, or dam, which was also equally famous. After a ride of 12 miles we struck a wide valley, down which flowed a river, and at a point where a few rows of pebbles diverted part of the water towards Kuruk was the dam, which thus proved to be no dam at all in the usual sense of the word; and yet there was once a dam here, built, it is said, by Tádud *Khatun*, the wife of the founder of the Sasanian dynasty. In any case, it is in response to this river that parts of Narmashír are as green as Sind, and one could only wish that an engineer might be called in to husband the priceless water, which, in flood-time, not only runs to waste, but causes infinite damage.

One feature of Narmashír is certainly the number of its deserted towns. Kuruk, for instance, which Mukaddasi described as a populous city, was only deserted in the nineteenth century, when Afghan and Baluch raids had become less serious, and the peasantry were able to live on the land. Many travellers point sadly to these ruins as a proof that Persia was once more thickly populated than to-day. They are, I think, mistaken, as it is, on the contrary, a proof that more peaceful, and consequently more prosperous, times have set in, as a result of which it is no longer necessary for the entire population of a district to be gathered into a few strongly fortified towns, such as those I am now describing.

From Kuruk we marched due north not far from the right bank of a sluggish reedy stream, which, taking its rise near Nisa, flows past Fahraj and disappears in the Lut. Villages abounded, but the jungle was thick, and nothing prepared us for the importance of the ruins of Chugukabád, or "Sparrow Town," which we traversed a few miles before striking the main Bam-Rigán route at Azizabád. This was the former city of Narmashír, and Mukaddasi, after referring to its dense population and fine palaces, mentions that Khorasán merchants trading

with Omán made their headquarters in this city. The area enclosed by its walls must, to judge by its extent, have been sufficient to shelter perhaps eighty thousand people. In the centre was a mound, on which were the crumbling walls which constituted all that is left of the great Kush-va-Ran * fort, but of the celebrated *minar* which once dominated the entire district we saw nothing. From its appearance, Narmashír city has been deserted for centuries, the latest reference to it being by Hamd Allah, who in the eighth (fourteenth) century mentions it as populous. To-day the jungle has gained the upper hand, and not even a hamlet exists on the site of this erstwhile proud city. After clearing these very interesting ruins, which are situated about a mile from the

PALMS AND POPLARS AT BAM.

right bank of the nameless river, we rode through thick jungle to our camp at Azizabád, pleased to have had the opportunity of examining what was, without doubt, the ancient city of Narmashír, which we found, as indicated by the Arab geographers, occupying a site half-way between Bam and Fahraj.

The next day we enjoyed some good francolin shooting, and camped at Burj-i-Aga-Mohamed, which was built by an Afghán chief. Indeed, until the Kájár dynasty was firmly established, Narmashír, like Khabís, was held by Afghan adventurers, Fahráj being the last

* This word apparently embodies the Kuch, who are often referred to in conjunction with the Baluch, and the Ran are the Rinds. Probably the fort was named after the raiders who were to be guarded against.

stronghold from which they were ejected, as late as three generations ago. One of my numerous Persian friends owned much of the property around the *burj*, or tower, and informed us that we were in the centre of the henna land. This valuable dye is sown in April, and most carefully watered for a year. It is then planted out, and still most carefully watered and manured for a second year. The plants, which somewhat resemble tea bushes, bear for an average of fifteen years, and the output of Narmashír is 1,800,000 lbs. per annum in a normal season. Owing to lack of enterprise, the crop is exported to Yezd, where it is ground by primitive stone mills. Thence it is sent all over Persia, and even penetrates to the distant Caucasus. Henna is used more especially for dyeing the nails of good Mohammedans, and, mixed with indigo, makes a grey beard glossy black. The Shah's horses have their tails dyed with the pure article, producing a curious effect, which will long be remembered by Londoners of the last generation.

Rigán is to-day the most important centre in the district of Narmashír, but it is little more than a fortified caravanserai, and possesses no commercial importance, which fact is somewhat remarkable, and is perhaps attributable to the very low type of the inhabitants of the districts, whose wants appear to be as limited as those of the Baluchis. To the south, some 3 miles distant, are the ruins of Jezán Khás, the fourth city of the district in Safavi times, but unknown, so far as I can ascertain, to the Arab geographers. Its plan closely resembled that of Chugukabád, there being a strong city wall with an interior keep, but the scale was smaller. This concluded the exploration of the ancient sites of Narmashír, and, as everywhere we enjoyed good shooting, and there was thick jungle in places, the members of the mission, who were painfully affected by the treelessness of Persia, voted the district the best and most fertile that they had struck since leaving Bandar Abbás.

We were, as mentioned before, on the main eastern artery of commerce, which, from Rigán, runs due north across the Lut to Neh.* We were naturally anxious to examine the pass by which the main range is crossed, and Rudbár, which lies to the south of this great mountain barrier, was consequently the next district to be examined. Supplies were again a difficulty, but by engaging thirty camels to carry forage and flour, we hoped to tide over that difficulty, and, as heavy snow had fallen, the water question was for once not acute. Leaving Rigán, we skirted Jezán Khas and modern Sangabád, a few miles beyond which the jungle ceased, and we made for a gap in the range up one of the huge gravel slopes which are such a feature of Persia. The stage was, however, 34 miles in length, and as our mules lost the

* *Vide* Trade Report for Khorasán, 1904–5, where this question is fully dealt with by me.

way, we were lucky to be able to settle down by midnight. The following day a gale was blowing, but we had to move on, and, after a comparatively easy rise, reached the summit of the Godár-i-Gíshu, or "Pass of the Oleander," at an elevation of 4100 feet. A few miles further west is the Godár-i-Sabzu, which is said to be equally easy. The importance of these two passes lies mainly in the fact that, owing to their comparatively low elevation, they are never closed by snow, and if South-east Persia be ever developed, they will become better known than to-day. It is of considerable interest to know that these rocky passes were crossed, more than 2000 years ago, by Krateros who, quitting the main army of the Greeks in the delta of the Indus, marched from Sind *viâ* Quetta to the Helmand, which he followed down to Seistán.

THE MIL-I-FARHÁD TO THE SOUTH OF THE GODÁR-I-GÍSHU.

He thence crossed the Lut *viâ* Nasratabád (Ispi), and joined Alexander the Great in the valley of the Halil Rud, "bringing the rest of the army and the elephants."* We camped on the south side of the pass, underneath an extraordinary rock, which is one of the wonders of the province. It is composed of grey, deeply indented limestone, and rises in the shape of a natural cone to an altitude of about 1000 feet. At its base is a shrine, which pilgrims occasionally visit, but it is for its shape that the Mil-i-Farhád is famous. The name contains a reference to Farhád, the legendary engineer of Khusru, and the lover of the renowned Shirin. From this stage, two long marches west across the level valley brought us to Bijenábád, in Rudbár. Throughout, supplies

* Arrian, vi. 27, 3. *Vide* 'Ten Thousand Miles in Persia,' xiv. 174.

were a cause for anxiety, as the district is inhabited by nomads, who do not store *kah*, or chopped straw. To add to our troubles, one of our horses died from the effects of oleander poisoning. *

Rudbár, which I have already described, was in the throes of revenue collecting. But we scraped together some forage and flour, and, after being detained by heavy rain, marched slowly up the valley of the Halil Rud to the district of Jiruft, where our difficulties ceased. We crossed the river to the right bank, and enjoyed the best francolin shooting in which I have ever participated, as one day with three guns we bagged over eighty head of game in two and a half hours. After exhausting our supply of cartridges, we recrossed the river in flood, when it justified its ancient name of Div Rud, or "Demon Flood," and made a flying visit to the upper reaches, where the hills would favour a modern dam, but where we found no traces of an ancient one. This concluded our work in this fertile valley, and, bound once again for Kermán, we crossed the Rudkhána Shur, which flows down from Dilfárd, and was also in flood. One baggage animal was drowned; but we finally reached the camping-ground at Saghdár with our kit intact, although a part of it was soaked.

The next day we started to march through the finest scenery of its kind in South-east Persia. East of us towered snow-clad peaks, and westwards we looked across a delightful valley covered with brilliant flowering scrub, to other giant ranges, and to the north Kuh-i-Hazár rose up in all its stately majesty. Thrice have I travelled along this route, and on each occasion the sense of pure pleasure which comes from perfect scenery has filled my mind with the desire to retrace my steps and loiter in such surroundings. Maskun, situated in the heart of the range, is connected with a pathetic story. Forty years ago there was an unusually heavy fall of snow, and, upon the road being cleared, the corpse of a European was found firmly wedged into the fork of a wild pistachio tree. The then Governor-General made inquiries, but in vain, and to this day who the solitary traveller was remains a mystery, and one which is hardly likely to be cleared up. We crossed the range by the Deh Bakri pass, 7380 feet above the sea (it is thus more than 3000 feet higher than the Gishu pass), and revelled in the superb view, which ranged from fertile Jiruft to the south, and covered league upon league of dull yellow Lut to the north. From Jiruft, as mentioned above, I was on a familiar route, and a few days after crossing the Jabal Bariz we reached Kermán, thus completing a most successful tour, during which every district of importance to the east and south-east of Kermán had been visited by the mission.

* Cf. Strabo, bk. xv. cap. ii. 7: "There was a plant resembling the laurel, which if eaten by the beasts of burden, caused them to die of epilepsy, accompanied by foaming at the mouth." This description is most accurate.

IV.

In February, 1905, I received instructions to the effect that I was appointed to Meshed, and the ensuing weeks were among the busiest that I have ever spent, as not only had I just returned from a long tour, which invariably means an accumulation of work, but my small office had, in addition, to cope with the accounts of the Commercial Mission. Farewell visits, too, took up much time, and I realized fully how great was the wrench of leaving Kermán when some of my oldest friends said that we should never meet again, and felt that, humanly speaking, this was the truth. However, there was little time for reflection, and at the end of March we said good-bye to Kermán, after a connection lasting for twelve years, which is not, I hope, finally severed.

The direct route to Meshed across the Lut was ruled out of court, as I was travelling *en famille*, and no carriage can cross it, whereas a brother of the Governor-General had reached Kermán from Khorasán but a few months previously *vid* Yezd and Tabas, and this fact determined the route we were to follow. As far as Yezd I was on familiar ground, but the journey across the Lut from that town was new to me, and promised to be of considerable interest.

During the nine years which have elapsed since I first had the honour of reading a paper before this Society, I have been constantly studying the great desert of Persia, which stretches in a south-easterly direction from close to Tehrán to the British frontier, a distance of perhaps 800 miles. Its width varies considerably, but it is never much less than 200 miles. I propose on the present occasion to deal with the subject somewhat more fully than I was competent to do at a time when I had only traversed it in one direction, whereas I have now either crossed or skirted it in almost every part. I am, unfortunately, not competent to discuss Persia from the point of view of a geological expert; but we have the authority of Blanford that during the Eocene period much of Baluchistán and Persia were under water. Mr. Huntington, to whose valuable and suggestive work on 'The Basin of Eastern Persia and Seistán' I would also acknowledge my indebtedness, considers that there was apparently oceanic connection between the Arabian sea and the Samartian sea, covering the Caspian basin, during which period the interior of the Irán basin formed a portion of this sea. We do not, however, know when the sea retreated; but it is evident that, as long as it remained, the climate of Asia must have been much moister than to-day. All this is, however, prehistoric, and has only been referred to as a necessary introduction to a description of the country as it is to-day, and, before proceeding farther, a brief reference to the physiography of Persia seems to be desirable.

The Irán plateau, as it is termed, but perhaps with little exactitude, consists of two great inland basins, the westerly one including the major portion of Persia. The easterly basin, which is mainly formed by the areas drained by the Helmand and Hari Rud, includes most of Afghanistán, part of Baluchistán, and only the eastern provinces of Persia, chief among which in geographical interest is Seistán. These vast basins are enclosed between two ranges, both of which take their origin in "the Roof of the World," as the Pamirs are picturesquely termed. The northern ranges run at first approximately south-west under the names of the Hindu Kush, the Kuh-i-Bába, and then the classical Paropamisus, the latter being the range to the north of Herát. Where this range terminates, a gap in the giant wall, which is some 1500 miles in length, allows the Hari Rud, known in its lower reaches as the Tejend river, to escape to the deserts of Turkestan. In Khorasán, the Kara Dagh is the name for the range north of Meshed, the rugged defiles of which are referred to in this paper in connection with my journey to the famous fastness of Kalát-i-Nádiri. Further west, in its central section, the Elburz range, by which name it is then known, separates Persia from the Caspian sea, throwing up the stupendous peak of Demavand, which rears its glorious cone to some 20,000 feet above sea-level, and is the joy of all lovers of beauty at Tehrán. The remaining section maintains a considerable elevation, albeit the passes are less difficult, and, trending to the north-west, this mighty barrier terminates in the Armenian plateau, which boasts of legendary Ararat, itself a peak some 17,000 feet in altitude.

The southern series of ranges is less imposing, but the chains are much longer owing to the fact that they form a rough semicircle to the diameter of the northern ranges. From the Takht-i-Suliman, the legendary home of the Afghans in Zhob, to the Kermán province, the ranges, which run at first south-west and then parallel to the Arabian sea, are more remarkable for their ruggedness than for any exceptional altitude. South of Kermán, however, are the Hazár and Lalazár ranges, both of which I climbed, and found the altitude to be about 14,000 feet, and, although this record is not exceeded, the ranges remain lofty until their regular north-west trend unites them to the northern series in the Armenian plateau.

With this brief introduction, which proves how completely the Irán plateaux are surrounded by mountains, we return to the Lut, whose existence is summed up in the one word "aridity," which aridity, it is to be noted, lies like a blight over the whole land. In more favoured lands, basins formed by upheavals are quickly converted into valleys, down which rivers rush to the sea. In Persia, on the contrary, the water forces were wholly inadequate to keep pace with the upheavals, but withered away before forming trunk river systems; in consequence, the scanty streams are lost in basins, known as *Hámun*,

within which are immense gravel slopes, salt lakes, and square leagues of sandhills. In no case does this drainage reach the sea. Observations for rain have been taken at the Meshed Consulate General for several years, and show that the average rainfall is only about 7 inches. The snowfall is now being recorded for the first time, and may average 3 inches.* At Tehrán, the average for the last five years of both the combined rain and snow fall is 9·19 inches.† These figures thus fully establish the arid nature of Northern Persia, which yet boasts of a heavier rainfall than South-east or Central Persia. The results of aridity are well described by Prof. Davis, and I cannot do better than quote him as follows: "When maturity, in an arid country, is so far advanced that the initial highlands of deformation are greatly dissected and degraded, we may picture the region as consisting of three kinds of surfaces: first, a central plain of aggradation, with fine-textured waste towards its centre, but with coarser-textured waste around its margin; second, degraded, rock-floored plains veneered with irregular patches of gravels and sands, and graded so as to slope gently to the central aggraded plain; and, third, residual mountains and hills, composed chiefly of those rocks which best resist arid erosion."‡ Nor should the power of the wind be overlooked. In a humid land, vegetation protects the soil; but, in Persia, the entire surface of the land is exposed to erosion, and it is by no means unusual to march over solid rock with but the very scantiest covering of gravel or sand, washed across it by flood action. From one point of view aeolian forces have more power than water, as the latter is checked by the fact that, however powerful it may be, the sea is its ultimate bourne, whereas wind can scoop out as it lists, and there is less ultimate limit to the degradation it can cause to a surface which is suited for its operations.

Of minor importance, but yet not to be neglected, is the enormous range of temperature in this treeless country, which is a powerful ally to the wind and other disintegrating forces. There is, I imagine, no country where the extremes are greater, and thus another and a potent force is ever weakening the rocks and co-operating with rain and wind for their destruction. Again, Persia is not only continental, but is surrounded on every side by countries all cursed with aridity. Thus there is little moisture in its wind. Owing to the extraordinarily complete series of ranges referred to above, most of such moisture as there is discharges on the outer wall. This is particularly the case in the Caspian provinces, where there is an excess of humidity, which

* I would mention that a small meteorological observatory is about to be constructed at Meshed, at which wind observations will be added to those already taken. It will be interesting to see whether the climate of India is in any way affected by that of Central Asia.

† In 1901, 5·28″; 1902, 9·52″; 1903, 10·38″; 1904, 13·02″; 1905, 7·76″.

‡ *Vide* "The Geographical Cycle in an Arid Climate," in the *Geographical Journal*, vol. 27, No. 1, of January, 1906.

makes it a hotbed of fever, whereas little or no moisture crosses the Elburz range to fertilize the plateau situated to its immediate south; in fact, the difference could not well be more striking. Yet another factor is that the basin-nature of the interior of Irán supplies no ranges of sufficient importance to attract clouds, and as the prevalent wind is from the north-west, *i.e.* from a cold to a hot region, no pressure is put on what clouds there are to discharge their contents. Nature has indeed been the reverse of lavish with her gifts, and man has systematically aggravated this unfortunate condition of affairs by ruthlessly burning every tree or bush and never attempting to replace the loss by planting. To-day, the coal deposits of Persia being scarcely touched, fuel is supplied either from fruit-trees grown by means of irrigation, or by scrub, with the result that there is no more treeless country in the world than Irán.

To conclude this brief sketch of the origin of the Lut, so far as can be judged, both Europe and Asia are drying up, a question dealt with in a paper termed "The Desiccation of Eur-Asia," by Prince Kropotkin.* It is there clearly demonstrated that, more especially in Central Asia and in Russia, there has been an alarming decrease in the rainfall, and that swamps and lakes are disappearing at a comparatively rapid rate. Recent Antarctic exploration also shows that there has been a noticeable recession of glaciers in the comparatively short period which has elapsed between the Ross and Scott expeditions. To summarize, the Lut is but the central and most arid portion, or, in other words, it is the most forcible expression of a generally arid country. Its aridity is caused by the general desiccation of Asia, by its continental position, and by the basin-like nature of the country and the prevalent winds. As if these disadvantages were not sufficient, man has destroyed almost all the forests which, until some few centuries ago, existed in various parts of the country. Finally, this aridity is increasing, and, except to an inappreciable extent, cannot be remedied by man.†

The horrors of the Lut are vividly described by various travellers; but by none better than by Mukaddasi, who once took seventy days to cross it, and refers to the ever-barring ranges, the dangerous salt swamps, and the extremes of heat and cold. At that date, and indeed until the last generation, the Baluchis, "a people with savage faces, evil hearts, and neither morals nor manners," as Mukaddasi calls them,

* *Vide Geographical Journal*, vol. 23 (1904), p. 722.

† In March, 1906, I received a letter from Dr. Sven Hedin, whom in Oriental phraseology one might well term the "Son of Geography." He wrote from Tabas that he had traversed the Lut from Tehrán to Jandak, whence he had crossed the Great Kavir from north to south. We may thus hope for a full scientific account from his pen of this same desert. Dr. Sven Hedin has since completed his examination of the Lut as far as Seistán.

terrorized the desert, and those whom they captured they did to death "as one would a snake, putting a man's head on a boulder and beating upon it until it be crushed in." This policy was adopted on the theory of dead men telling no tales, and the barbarous fashion of the murder was justified on the grounds that it saved the edge of their swords.

I now propose to make a few remarks on the nomenclature of this funereal waste. The Arab writers almost invariably used the term *mafáza*, which is an Arabic word signifying a wilderness.* Persians too, generally speaking, employed the same term, which was, however, in time replaced by that of *Kavir*, or *Kafa*, as it is pronounced in Southern Persia. The etymology of *Kavir* is uncertain, but it signifies a salt desert. Until quite recently, this word appeared on all Persian maps as the designation for the great waste which occupies the heart of Persia. To-day, however, *Kavir* in its turn has been replaced by the word *Lut* as the one general expression, *Kavir* being reserved for such portions of the desert as are salty. In the north huge expanses are known by this term, and also separate tracts, as, for instance, the wide strip which runs from the south of the basin of the Zenda Rud past Sirján, in the Kermán province, and which has already been referred to above; in fact, all over Persia these *kavirs* are numerous.

The origin of the word *Lut* is interesting, and deserves our close study. In various parts of the desolating area guides tell the traveller of ancient cities which were destroyed by the Almighty with fire from heaven. Upon inspection, it is evident that these so-called "cities" are but bluffs worn and fretted by the action of the fierce winds and rain until they—

> "Formed turret, dome, and battlement,
> Or seemed fantastically set,
> With cupola or minaret." †

Here, in my opinion, the origin of the word is to be sought, and surely no more fitting name than that of *Lut*,‡ as Abraham's nephew is termed in the east, could possibly be connected with a waste which extends so far and is so terrible that its blighting influence separates provinces more effectually than a stormy sea or any range of mountains. It is only fair to state that some Persians derive the word from *Lut*, which signifies "naked;" but the above is, I think, the true derivation. Before arriving at the conviction that I was correct in what I have stated above, I not only questioned many Persians likely to know, but I also consulted various modern Persian works on geography. In the

* Násir-i-Khusru, who, in A.H. 444 (1052), travelled from Náin to Tabas, refers to the desert as the *Biyaban*, or "Waterless Land."

† "The Lady of the Lake."

‡ I would add that the story of Lot is well known to Mohammedans from the Koran, and that, as may be supposed, their language has been profoundly affected by it. "In the year of Noah" is also an expression taken from the Koran, which is in common use.

older ones, written perhaps twenty years ago, the word *Lut* never appears. However, in an atlas published some seven years ago the word *Lut* is rightly shown as the one general name. Its spelling is that of the theory rejected by me. I next turned to Arabic works, and in the modern Arabic Geography, known as the *Annukhbat-ul-Azarhia*, or the "Fresh Shoots," and published in 1903, the word *Lut* is printed so as to corroborate my views.* Geography is not much studied in Persia, and philology a good deal less, and I think that this somewhat obscure question of nomenclature may now be considered to be finally settled.

To the north-east of Yezd the Lut is narrower than at any other point, and, in consequence, a caravan route has from the earliest times undoubtedly crossed the desert in this section. The north-west trend of the ranges of Persia is its best known orographical feature, and as our direction lay north-east, we regularly crossed range after range at right angles, each range decreasing in height as we neared Tabas. At distances sometimes exceeding 40 miles are *robat*, or fortified villages, where scanty supplies can be purchased at high rates. Between them there is an occasional *áb-ambár*, or water-tank, which is probably full in the spring and empty in the autumn. The monotony of these sterile ranges, the drainage of which runs south-east to be lost in the Lut, is more than trying; but yet many of the villages along the route are flourishing, as their inhabitants possess a monopoly of supplies.

Four sowars and a hospital assistant had been despatched from Turbat-i-Heideri to replace our Sikhs, from whom we parted with great and—I believe—mutual regret at Yezd. To give an idea of what the Lut actually is, I propose to describe a typical march, and have selected that from Kharána to Sághand, a distance of 37 miles. Kharána, I would mention incidentally, is the Khazána of Ibn Khurdadbih, the earliest of the Arab geographers, who wrote in the third (ninth) century.

We started off, as usual, about an hour before dawn, or, in other words, as soon as it was safe for the carriage to move. A caravan of pilgrims, bound for Meshed, was also afoot, and it was most interesting to watch the motley procession. Men of position rode horses, their wives being packed into *kajáva*, which are two square crates slung across a mule. The poor rode donkeys or walked, and every now and then a prayer would be started and repeated with genuine fervour by all present. A few sleek *mullas* were particularly assiduous in reading prayers, mainly to ladies, as the caravan moved along in picturesque confusion; but there were no signs of any one

* Lot, the nephew of Abraham, is written لوط. The word signifying "naked" is اوت.

being on the alert, and, as the event proved, their remissness was severely punished. Kharána is picturesquely situated, and has a curious aqueduct. It is surrounded by much broken ground, which, although pleasing to the eye, was very trying for the carriage, the wheels of which were lashed together, while villagers were engaged to support it on each side. With much difficulty it ultimately slid down unbroken into a stony but wide river-bed, where our guides informed us that there were no further obstacles ahead, and we paid them off. Four miles from Kharána we passed a round watch-tower, inhabited by a single family, with a tiny strip of cultivated land, and, quitting the watercourse 3 miles lower down, we skirted a huge gravel slope, which stretched for many miles up to a low range of hills and was typical of the Lut, being absolutely naked, sun-scorched, and desolate. At 18 miles we crossed the level salty valley bottom, which is also typical, and began to rise steadily, the ruined caravanserai of Rizáb being visible in the distance. Approaching it, at some 24 miles, we found it to be situated close to a rough defile, by which the road from Náin joins that from Yezd. Rizáb is sinister both in appearance and in fact, and only a year previously my cousin, Mr. Herbert Sykes, had had his advance camp attacked at this spot. I took all possible precautions; but as it was out of the question for the carriage with my son, who was less than two years old, to keep with the mules, we were obliged to split up the party, and consequently suffered much anxiety. The four willing carriage horses and our own riding-horses required rest and a feed after travelling so many miles across the stony waste, and we consequently halted at Rizáb for some hours with a sowar on guard, until our mules overtook the carriage. We then allowed them an hour's start, and proceeded on our journey, accompanied by a second caravan of pilgrims which we had overtaken at Rizáb. The coachman from his high seat said that he saw men watching us from the gorge, and the event proved that he was right, for two hours after our departure a gang of some twenty robbers swooped down on Rizáb and captured the caravan with the pious ladies and the sleek *mullas*. Every one was bound and carefully searched, and, after being relieved of most of their clothes and all their valuables, the disconsolate pilgrims were released.

(To be continued.)

THE INDIAN OCEAN.

Being Results largely based on the Work of the Percy Sladen Expedition in H.M.S. "Sealark," Comm. B. T. Somerville, 1905.*

By J. STANLEY GARDINER, M.A., Fellow of Gonville and Caius College, and Demonstrator of Animal Morphology in the University of Cambridge.

We may at this point, before proceeding to the Seychelles, consider some of the bearings of our cruise on the formation of coral reefs.

1. Starting with the land, we are met everywhere with evidences of a change of level having been largely responsible for its formation. This is true also of the groups of atolls in the Pacific, and seems to be a regular phenomenon in the Indo-Pacific. At the same time, we have indubitable evidence of certain islets on coral reefs having been formed by the piling up of reef material. The change required varies from 10 to about 25 feet, and, while admitting that in places such a change of level could be accounted for by the attraction of the surrounding continents on the water, we consider that it must rather be explained by some general phenomenon. This must be left to other investigators, but we draw attention to the matter as one worthy of study.†

2. The lagoon of every atoll we visited seemed to be increasing in size. Sir John Murray, in an unpublished comparison that he made of the charts of 1837 and 1885 of Diego Garcia, which he has favoured us with, points out that in the part recharted the lagoon would appear to have increased about 2 square miles in size. Without discussing this result in any way, I may merely note that we found the whole lagoon shore of Diego Garcia to be fringed with low cliffs, or with fallen and undermined coconut and other trees. In Salomon there were indications of land having extended out to the edge of the present lagoon reef, and in St. Joseph the increase was no less clear. Elsewhere the evidence all pointed in the same direction, and a rule seems to be established for the whole region.

3. The fringing flat around the seaward sides of the islands would appear generally to have been formed by an outgrowth and upgrowth of corals and nullipores, and to be everywhere growing outwards; off St. Pierre and Eagle it was, however, formed by the cutting down of the present islands. Above 5 fathoms it is being built mainly by nullipores; but below, down to 30 fathoms, of reef corals, which are being simply cemented by these algæ.

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* Read at the Royal Geographical Society, June 11, 1906. Map, p. 424. Continued from p. 332.

† If we suppose the south polar regions to have been free from ice in recent times, and to be now covered with 109 feet of ice (or 100 feet of water), we find that, supposing no change to have taken place meantime in the topography of the world, about 5 feet of water would have been withdrawn from every part of the ocean, reducing it by the same amount in height.

SOUTH ISLAND, FARQUHAR, SHOWING THE HIGHEST POINT OF THE SAND RIDGE.

4. The steep, which was found round every reef and bank save to the south of Great Saya de Malha, is built up by masses of coral rock from the reef above, its angle representing that at which such material comes to rest in sea-water. It is being consolidated to some degree by fragments of coral and shell, and by foraminiferal sand, as well as by sponges, polytrema, and polyzoa. The outer slope beyond this depends very largely on the contour of the original mound on which the reef or bank was built up, but is also greatly affected by the tailing off of the deposit forming the steep.

5. The formation of a reef depends on the interrelations of a large series of conditions, but a main factor is the depth down to which corals and nullipores can live and flourish. A series of over a hundred dredgings on the submerged banks near the Seychelles, made partially to settle this point, gives the limit for reef corals at 35 fathoms, and for nullipores at 65 fathoms; but it should be noted that these forms can grow with extraordinary luxuriance at 28 and 50 fathoms.

6. Non-calcareous marine plants may be generally neglected in so far as they affect coral reefs, but on all the banks of the Seychelles and Farquhar series they were extraordinarily abundant. Marine algæ would seem, indeed, to cover large areas of their surfaces down to about 50 fathoms, and would, of course, bind together mud and sand and prevent deepening. The presence of broad reef flats, as to the east of Coetivy, in no way hollowed out inside, and the smallness of the

lagoons, as at Farquhar, are largely to be ascribed to the binding together of the sand and coral by the roots of two or three species of Zostera.

Lastly, it may not be out of place if we add a few words about the Seychelles. They comprise two coral islands and seventeen granite islands, of upwards of 150 square miles in size, situated on a bank about 300 miles long by 100 broad, perhaps 12,000 square miles. The two coral islands lie to the north-west of the bank, where alone there is a trace of a barrier commencing to grow up. The granite islands all rest on the centre of the bank, and such shoals as occur near them are not, so far as we could ascertain, of coral origin. Immediately around the granite islands are here and there fringing reefs, especially in bays; but these, if of any great size, have in every place that we saw around Praslin, La Digue, and Mahé granite islets, or masses, to give them, as it were, support and to show their foundations. Nullipores practically do not enter into their composition, and such coral masses as grow are of comparatively small size. Indeed, most owe their origin to the piling up of calcareous and siliceous sand in bays, or to the cutting down and removal of the granite above the sea-level. Yet the absence of nullipores is the important point, nothing else really being wanting for the formation of true coral flats. In no case do these calcareous plants grow well in lagoons or enclosed waters, and their absence from the centre of the Seychelles bank—they grow well on the edges—is presumably due to the churning up of the water and to the removal

NODDIES NESTING ON SIREN ISLAND, CARGADOS CARAJOS.

ST. JOSEPH ATOLL, AMIRANTE GROUP. VIEW OVER THE LAGOON FROM THE EAST END.

from it of all carbonic acid gas by seaweeds, etc., before it reaches the islands.

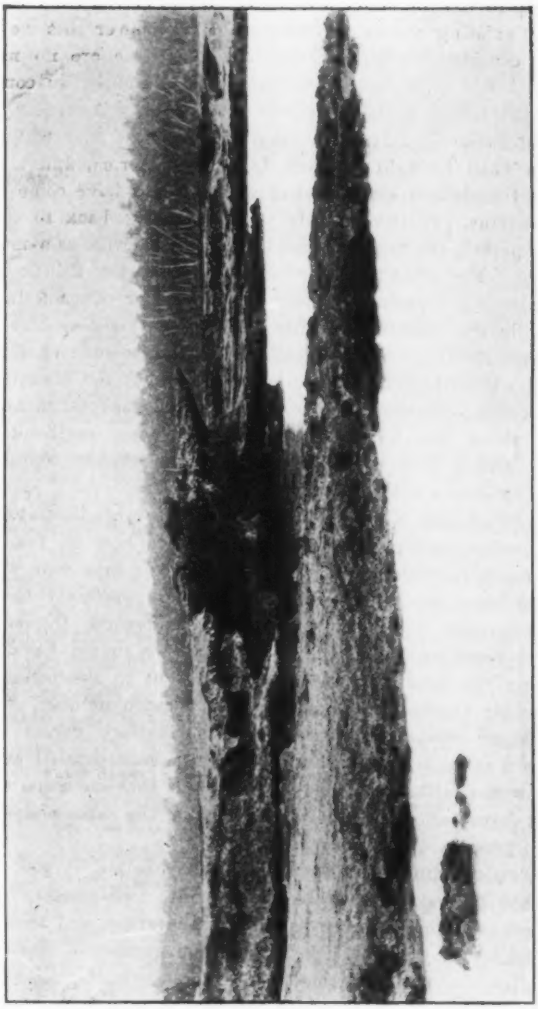
The granite throughout the Seychelles is very uniform in its composition, but it exhibits here and there dykes of finer grain, down which the streams have cut their courses. Exposed mountain faces, and even quite isolated rocks, are deeply scored by the rain, which averages at least 120 inches a year. There is a marked tendency to form precipices, at the foot of which accumulate rectangular masses of granite, the splitting up of this rock being horizontal in the first instance. The tendency of all granites is, of course, to form massive domed hills or bosses. But the hills in the Seychelles are so deeply furrowed and cut up into sharp ridges that they bear striking testimony to the long period during which atmospheric agencies have been at work. The result, no doubt, has been mainly brought about by the weather, but to some degree marine erosion by the coast may have played a part. Around Praslin Mr. Foster Cooper found in five places masses of coral attached to granite rocks at various heights up to 30 feet above the sea, and to the south of Mahé there are also evidences of a similar change of level. Even then the sea could not have produced much effect, since generally the precipitous slopes of the hills arise at a much higher level and some way back from the shore. The island of Mahé is the most characteristic, in that it slopes along its eastern (or windward) face up from the beach to a line of precipices, arising at 150 to 250 feet

above the sea, situated a quarter to half a mile behind the shore, and cut only where mountain streams descend. Its western face is similar, but the slope is more gradual everywhere, and the precipices are less marked. Even at first we were struck by the resemblance of the eastern line to the cliffs of parts of the Devon and Irish coasts, and near Mamelle stream we saw what appeared to be traces of marine erosion. Unfortunately, there was no elevated deposit, but this is scarcely surprising when we consider the rainfall, and notice the deeply scored granite masses near the coast. However, the line of cliffs so remarkably resembles a coast-line that we are still inclined to believe that it was so formed, and that there has been a comparatively recent elevation of upwards of 200 feet.

At this point we cannot avoid some consideration of the terrestrial fauna and flora of the Seychelles (which are extraordinarily rich in endemic species and genera) in reference to its possible connections in the past with other lands. It is a truism to remark that the fauna is largely a function of the flora, since it is in the last instance entirely dependent upon it; the two, therefore, should be considered together. As a general rule we are inclined, in the first place, to suggest that not only the presence, but also the absence, of each form of life is of importance for our purpose in any lands we are investigating. We should prepare a list of the organisms of the areas, showing both the species and genera common to each pair of districts, and the proportion they bear to their respective faunas and floras. We should probably by this means be enabled to establish which is the parent area, if there be one. Next we inquire how many, or what proportion, of the common forms might reasonably have passed from the parent to the daughter by existing means—in the present case to the Seychelles from Madagascar—by aërial or marine transport. Our opinion is that such means are much underrated, especially in the Indian ocean, as we found driftwood on nearly every island we visited, large trees, squared timbers, and quantities of bamboos, the latter only found by us growing on Mauritius and the Seychelles.

A *prima facie* connection being established between any two lands, we examine one by one the origin of the forms not the same, to ascertain why each organism or group is not found in each locality. Here it will be necessary to consider the geological ages of the different groups of organisms. This, from the forms common to the two lands, will enable us to trace to some degree the date of any connection, and allow some reconstruction of their life at that period. Lastly, but of perhaps greater importance, we have to investigate the special geographical problems involved. We must ascertain whether each area has similar environments, and to some degree we must especially compare the organisms of such. We also require to examine the topographical changes of our daughter area in the past, so far as we know them, in connection

with physical conditions. This is of the greatest importance in respect to islands exhibiting either volcanic activity, or increase or decrease in



DIEGO GARCIA ATOLL, CHAGOS. LAGOON SHORE OF SOUTH END, WITH OVERHANGING CLIFF.

size by elevation, subsidence, or marine action. The latter will be obvious when one remembers that a reduction commonly implies an increase in the salinity of the air, in the force of the wind, and in the

rainfall, and that these may induce a profound change in the vegetation, with necessarily almost as great a change in the fauna.

Could the organic life of the Seychelles, granting its special relationship to that of Madagascar, have been derived from the latter locality by existing means of transport? To answer this we require to briefly consider its fauna and flora. As there are no mammals (except rats and bats) in the Seychelles, any connection could only have existed before Madagascar was peopled with mammals. There is one freshwater chelonian (*Sternothœrus sinuatus*), a form which might well have been brought by man from East Africa, and a limited number of lizards and snakes, all of which might have come by sea.* Three cœcilians, primitive beasts probably going back to the early Secondary period, are more difficult to explain, as well as a mountain-loving frog. The other two batrachians and the two fish do not give much evidence compared with the large number of each in Madagascar, while the existence of only about twenty-six species of land shells (some of which certainly attained their specific characters in the islands) is surprising on the assumption that the localities were ever connected. Tracheate arthropods are of no assistance, and there are only three freshwater crustaceans, very few earthworms, one Planarian, and a Nemertean, which probably became adapted to a terrestrial existence within the group itself.

If the Seychelles is indeed the remains of a large land at one time connected with Madagascar, we would inquire how its fauna could have become so restricted. In the absence from competition with new forms from large land areas, its islands should certainly have some animals retaining primitive characteristics beyond the cœcilians. Seeing the resemblances of the two faunas, we should have to suppose, taking the latest possible date antecedent to the pangolin and lemurs having reached Madagascar, that a large number of genera have remained the same since the early Tertiary period in both localities, or, as an alternative, that there has been parallel evolution. If we allow the latter, we must further grant that the same environment may have called out, in course of time, the same characters in forms once perchance widely separated.

When we examined the flora of the Seychelles, it was at once obvious that its species must be divided into two classes, *i.e.* those which affect a subsoil mainly composed of limestone, and those which affect the siliceous grounds. A considerable number of each kind of plant will live on areas intermediate in their subsoils, but not 5 per cent. of each really encroach on to the other's land. Now, the lime-

* There is the analogous case of a tortoise in Diego Garcia, almost certainly introduced by the negroes. A crocodile existed in the Seychelles, certainly less than a century ago, and its remains have been found sub-fossil; a crocodile may be semi-marine.

ST. JOSEPH ATOLL, AMIRANTE GROUP. LAGOON SHORE, SHOWING REMAINS OF FIVE BEACHES LEFT ON THE FLAT AS THE ISLAND WAS WASHED AWAY.

stone, or calciphilous, plants are precisely the same as we found in the Chagos, in the Amirantes, in Coetivy, and in Farquhar, any former land connections of which are out of the question. Of course the areas suitable for such plants in the Seychelles are not large, but the point is a most important one. It is, of course, possible to regard the calcareous land as of quite recent formation; but even then we should expect to find some calciphilous plants evolved from the siliciphilous, whereas the two floras are sharply distinct. The question at once arises as to whether the siliciphilous plants could not also have been carried over an intervening ocean in the first instance. The palms and many of the large trees are peculiar species and genera, but supposing that they have always had seeds more or less similar to what they at present possess, they could certainly have been ocean-borne; the lower plants, too, with their spores, could just as assuredly have been carried by the wind. The flora, indeed, obviously requires a closer examination and analysis than it has as yet been afforded.*

We are now left, both from the fauna and the flora, with the most meagre evidence of any former land connection of the Seychelles with Madagascar, and we have only, in conclusion, to consider it in reference

* It is interesting to note that the flats, wherever they exist around the Seychelles islands, are covered with green algæ of species never found by us elsewhere during the cruise.

to the geography of the two localities. We would at once emphasize the fact of the existence of an Indo-Madagascar continent, and also that our two localities are formed of the same, or closely related, granites, a class of rock associated with continental areas. We observe that there is no sign of any marine action over four-fifths of the present land of the Seychelles islands, and that there is evidence that atmospheric agencies have been acting upon the rocks and hills for a long period of time. Supposing that the Seychelles were connected to Madagascar in the late Secondary period (when the cœcilians and perhaps other animals and plants came in), and that the island when first cut off was the size of the present bank, is it not probable that the subsequent changes from an area of 12,000 square miles to one of 150 in seventeen isolated islets would cause the extinction of nearly all the fauna and most of the flora? Judging by the analogy of other islands, the central part, where the present islets would have been situated, must have been a moderately dry savannah country, whereas it is now a regular tropical moist district. In the process of reduction

VIEW ON PRASLIN, SEYCHELLES. SCORED GRANITE CLIFF, WITH COCONUTS BELOW.

very many, if not most, of the plants would have disappeared. Vast numbers of insects would have died out, together with all animals which fed on them. Finally, the destruction of most of those which still managed to survive would have been wrought by more efficient forms arriving from over the sea, or evolving out of the same, this new set that which now certainly dominates the fauna, and very probably the flora as well.*

We may add one word in conclusion as to the importance to this country of the Seychelles. Commercially it is at present depressed, but it was for many years the leading vanilla-producing country of the world. That industry was largely destroyed by the discovery of a chemical substitute, but the islands will again flourish under Para rubber and coconuts—and when English law replaces the Code Napoleon. The inner harbour at Port Victoria, Mahé, is a good one, with deep water close to the pier, and there is a large protected outer roadstead with sufficient water for the deepest-draught ships.

Situated almost equidistant from the track around Madagascar and from the exit of the Red sea, and also lying outside the hurricane zone, with an equitable climate, with high lands close to the sea, and with no tropical fevers or diseases, the Seychelles would form an ideal centre and sanatorium for an Indian ocean squadron. With it as a base, with fast cruisers possessed of wireless telegraphy, no movement of an enemy's fleet in any direction could escape notice between Mauritius and Aden, while the position absolutely dominates East Africa and one end of Madagascar as well. Furthermore, it might be a valuable coaling station between the Red sea and Australia, and was indeed, as was also Diego Garcia in the Chagos, once used as such. Of course, with our stations at Aden and at the Cape, the Seychelles may not be of much use to us, but our supremacy in the western half of the Indian ocean would be seriously affected were it in the hands of a hostile power.

Lastly, there are certain forms of work on board ship which in the tropics are scarcely suitable for white men, and "seedee" boys are commonly employed. Some of the Indian lascars are excellent; but the crew, up to the sarang and tindals (boatswain and his mates), must be of one nationality. This is a serious drawback, but the Seychelles negroes answer every requirement for the purpose. Largely the descendants of negro slaves from captured dhows, they are thoroughly loyal to the English. Reared of mixed negro bloods, in an excellent climate and accustomed to the sea from childhood, they are of grand

* I would like here to express my gratitude to my friend and teacher, Dr. Gadow, for discussing with me the questions relating to the distribution of the land animals and plants. I have received many valuable suggestions and much useful information from him, but I alone must be held responsible for the opinions expressed in this paper.

physique, and remarkably free from disease. Christians in religion, with no trace of their own cults, cheerful, laughing, and happy in their dispositions, their highest ideals the British bluejackets, con-

PORT GLAND, MAHÉ, SEYCHELLES. FRINGING REEF, WITH GRANITE ISLETS AND MASSES; ÎLE THERESE TO RIGHT.

siderably more intelligent than the Africans, and absolutely fearless, we venture to think that they may, if encouraged, form a race of hardy navigators of immense value to the British dominion in the Indian ocean.

In conclusion, we would desire to express our indebtedness to the Admiralty for allowing H.M.S. *Sealark* to undertake this cruise from Ceylon to Seychelles; to the late Admiral Sir William Wharton, and to Captain (now Rear-Admiral) Arthur M. Field, hydrographers (under whose orders the cruise was arranged), for their most willing aid and personal interest; to Commander Boyle T. Somerville and the officers of H.M.S. *Sealark*, who carried out most of the topographical, meteorological, and oceanographical work; to Mr. C. Forster Cooper, naturalist; to Mr. T. Bainbrigge Fletcher, paymaster, and Surgeon Simpson, who assisted respectively in the land zoology and botany; and especially to the Royal Society, to Mr. Adam Sedgwick, to the late Dr. W. T. Blanford, to Sir John Murray, to Prof. Herdman, and to many friends for their assistance and advice. The expedition was largely financed by the managers of the Percy Sladen Memorial Fund, by the managers of the Balfour Fund, and by the British Association.

Before the paper, the PRESIDENT: I have now to introduce to you Mr. Stanley Gardiner, one of our most thoughtful and experienced biologists, who gave us an excellent paper in January, 1902, on the subject of his explorations in and about the Maldive islands. Prior to that, as far back as ten years ago, Mr. Stanley Gardiner was biologist of the well-known expedition of H.M.S. *Penguin*, then commanded by the present Hydrographer, Admiral Field, who is here to-night. Recently Mr. Gardiner has devoted himself to the subject of the Indian ocean, and after much preparation, he spent a great part of 1905 examining the geography and the biology of its islands. This work, which he is about to describe to us to-night, was very successful, thanks in the first place to the Admiralty, who (moved by the Royal Society) were good enough to allow Mr. Gardiner to voyage about in H.M.S. *Sealark*, then employed in hydrographical work in the Indian ocean. I hope that Admiral Field will, later on, speak about that point. A large portion of the money needed for the expedition was found by Mr. Gardiner himself; another large portion of it was found by the Percy Sladen Fund, about which I may say a few words, for although I think memorials have been somewhat overdone of late years, some are most useful. The Percy Sladen Memorial was initiated by Mrs. Percy Sladen in the memory of her husband, who, as you know, was a distinguished zoologist. The amount collected was about £20,000, and, as through its help excellent work such as that done by Mr. Stanley Gardiner is enabled to be carried out, we must, I think, agree that the fund has justified its existence. I will now call upon Mr. Stanley Gardiner to read his paper.

After the paper, the PRESIDENT: I will ask the Hydrographer, Admiral Field, to say a few words.

Admiral FIELD: The scientific results of this expedition would, I think, take very much longer time to work out thoroughly than the time during which the expedition lasted. The idea of the expedition was originally suggested by Mr. Stanley Gardiner to the Admiralty about two years ago. It was backed up by the Royal Society, and the Admiralty found themselves able, I am glad to say, to lend a ship. Our survey vessels are so few in number that, although the Admiralty have every desire to assist scientific research, in view of the incessant demands for modern surveys for the benefit of practical navigation, it is very difficult indeed to set aside a ship for purely scientific purposes, for any

lengthened period at any rate. The original programme was unavoidably and considerably curtailed, I am sorry to say, as it was necessary to bring it within the limits of the time for which the Admiralty could give the ship; but it was possible to spare the *Sealark* for six months when she was unable to work on the coast of Ceylon. The Indian ocean has been very little traversed by our survey ships of late years, and in comparison with the north and south Atlantic, and the south-west Pacific in particular, very little sounding has been carried out there in recent years. There is an immense deal of surveying work to be done in those waters, both in the Chagos archipelago, Seychelles, and other coral banks of large extent, besides deep-sea exploration. From a purely hydrographical point of view, the time was too short to be able to do much more than fix the astronomical positions of certain points in order to adjust the existing surveys and to make use of them to the fullest extent; but it was possible to combine such surveying work with the scientific researches which Mr. Gardiner desired to carry out, which will be of very great value. Turning to a few points in the lecture, the lecturer assumes the land connection between India and Madagascar, and suggests the action of tides of extraordinary force in the open sea, which he supposes to have extended at that period about halfway round the world near the equator, and that these tides would be instrumental in the disappearance of the land as it then existed. That assumption would involve currents of enormous magnitude, I should imagine—much more than we have ever been able to trace in the present day, at any rate; and the tides would have to have been very greatly enhanced in those days to produce such results. But Mr. Gardiner has rather assumed the existence of these very deep and strong currents, and I do not think that we have sufficient evidence yet to say positively that they do exist at a very great depth in great strength. The evidence which he has adduced, derived from the trend of the sounding-lines and dredges, I think I should be inclined to investigate a little more closely before I should be disposed to accept it altogether; and we have no positive evidence. We have not put a current-meter down at those depths, and until we get that current-meter down, I should be inclined to suspend judgment on the point. Upon these great currents depends very much the argument of the theory. There is, however, I may say, one instance that I know of supporting the view of deep currents. There is the case of breakers having been reported in localities which, when they were subsequently examined, showed no sign of shallow water; depths having been found in one instance of 800 fathoms, and in another of 200 or 300 fathoms. I think there was no doubt about breakers having been seen, and I should be inclined to ascribe them to tide rips caused by the tidal undulation meeting obstruction in the ocean, and setting up a local current which made itself apparent at the surface. So there is that degree of evidence, I admit. The deep-sea soundings of the *Sealark* have added very considerably to our knowledge of the topography of the Indian ocean; but the area to be investigated is so great, and the Indian ocean has unavoidably been so much neglected, compared with other parts, that any attempt to draw contour-lines must still, I am afraid, be an effort of the imagination. Still, it must be admitted that it is astonishing what can be done in the way of drawing contour-lines with very scanty material, as shown by Sir John Murray's work, when viewed in the light of subsequent soundings which have been obtained since he drew his contour-lines. As an illustration of how contour-lines drawn on insufficient data may be upset, I may mention a coral bank of 34 fathoms, lying midway between Mauritius and Cargados, within 30 miles of one of the *Sealark's* soundings of nearly 2000 fathoms. This bank was accidentally discovered by a passing steamer a few months after the *Sealark* was there; she was

letting her sounding-wire run out to see if the Thomson machine was clear, and so discovered this bank. It was unfortunate that both of the *Sealark's* deep-sea sounding machines became disabled before the end of the cruise, and that prevented exhaustive searching for vigias. These vigias are often very troublesome to disprove owing to the vague reports of their position. Searching for them is very anxious work for the commanding officer, as I know well in my own experience. Of late years, from our knowledge of the probable slopes of submarine banks at different depths, it is possible to form some idea of the limits of the safety zone surrounding deep soundings. For instance, I know of no case of a dangerous bank existing within 6 or 7 miles of a 2000-fathom sounding, and one can feel tolerably certain that there is no danger within 3 or 4 miles of 1500 fathoms; but a danger may exist within 2 miles of a sounding of 1000 fathoms. These rough practical rules I have found of great service, both in avoiding dangers at night and in searching for them in the daytime. I think it is right to point out that there is some danger in drawing conclusions, such as the lecturer seems to suggest, from a comparison between charts of sixty or seventy years ago and those of the present day. The work of many years ago was carried out, of course under great difficulties, by sailing ships, and in many cases is not in sufficient detail to allow deductions of the kind that are suggested to be safely drawn. The limitations of time, and the immense area that had to be covered, and was covered, by the older surveyors, would necessarily preclude details unimportant to navigation being accurately charted. And I think that there is considerable danger with people who are not acquainted with the way in which hydrographic surveys are carried out, that they may be inclined to think the work more accurate than it is. In former days it was not possible to do it with the same degree of accuracy as it is in these later days. I will not detain the meeting with any further remarks, but before sitting down I should just like to thank Mr. Gardiner for his very interesting lecture.

The PRESIDENT: As this is rather a sailors' night, I would ask Captain Creak to say a few words.

Captain CREAK: I am afraid, after the full discussion of this subject to which we have already listened, I cannot add very much. Recognizing the connection between geology and terrestrial magnetism, I would point out that on the East Coast of Africa, and in the region under discussion, where the magnetic needle had been comparatively restful for many years previous to 1880, there has since been a remarkable outburst of magnetic change, continuing to the present time. Whether that has any connection with the observed rise and fall of the land, I would not yet venture to say, but I may give an instance in point. After the great explosion of Krakatoa there was a marked change in the behaviour of the magnetic needle at the neighbouring observatories. I would suggest the desirability of a proper magnetic survey as one means of settling the matter. I think that Admiral Field has adduced a strong point—that there is as yet no evidence for currents of the strength suggested in the paper, and until we have tried all these places with the current-meter at different depths, I do not think we have any ground to support us in thinking that they exist. I have never heard of any ocean current which would produce the great changes that are going on. I think there must be some other cause. Perhaps, as the lecturer says, in seventy or eighty years we may know more about it.

The PRESIDENT: I think we should now like to hear something on the geological side of the question, and perhaps Mr. Lydekker, who is on the Geological Survey of India, and who is also a geographer, will favour us with a few remarks.

Mr. R. Lydekker: It is rather difficult to criticize a paper of such length, which covers such a wide field as that which Mr. Gardiner has laid before us this evening. I may say that I can only discuss one very small portion of it, and at this late hour of the evening I will do so very briefly. Mr. Gardiner talks, I believe, about Madagascar and India being connected by a narrow zone during the Secondary period, but I think he has put the clock on a little bit too fast. A Fellow of this Society, who perhaps did more to enhance our knowledge of the distribution of animals than anybody else, the late Dr. Blanford, expressed very strongly the opinion that there was a great belt of land which connected Africa, Australia, and America together, and that this persisted during the whole of the Secondary period. The evidence is convincing, because we get the same plants in India, in Africa, and in South America. There is also reason to believe that there was a strip of land, during the Secondary period, connecting Madagascar and India. I venture to think, however, that the reader of the paper has made a little too much point of bringing out the latter connection as a main feature, when I think it is a minor feature. Undoubtedly it existed. If Fellows will refer to an article in this month's *Popular Science Monthly*, an American magazine, they will see an interesting account of South American fishes, in which the writer argues that the connection between Africa and America must have persisted to the Eocene period, when our author says apparently only the India-Madagascar line remained. I believe, therefore, that the main equatorial connection existed much later than the author says. With regard to the action of currents on the connection between Madagascar and India, you have to take into consideration that most of the old land connection between India, Australia, and Africa has been removed; and I do not suppose any one is going to tell you that currents cut out the whole Indian ocean. The probability is there must have been continuity of action, and that the action which carved out the Indian ocean must have also been the main cause that separated Madagascar and the Seychelles from India. There must have been some cause other than currents, and I think subsidence must have played a very important part.

I ought not to trespass further on your time at this late hour, but there is an interesting point about this connection between Madagascar and Ceylon I should like to have explained. I believe the connection must have still existed in the Miocene period; but the Seychelles, which are granite islands, we are told, are apparently not remnants of that connection, and I do not therefore see how they got their tortoises. [Here the speaker was corrected by the author in regard to the Seychelles.] I accept this correction, but still fail to see how the giant tortoises got to the other islands, which are said to be purely coral. It is all right to find them on the Seychelles, but I want it explained how they got on the others. My chief points are, first, that the clock has been put a little too fast, and that the main equatorial belt persisted later than the author believes, and that the Madagascar-Ceylon connection, I should say, was also rather later. With regard to the current question, I maintain that whatever carved out the great Indian ocean, the same action must have cut away the connection between Madagascar and Ceylon, although it may have been finally aided by the currents. The whole matter is a very interesting and a very difficult problem; and I am sure that, though we may differ in details, we shall agree that what Mr. Gardiner has done is of great interest and importance.

Dr. Mill: The main point in this paper is not, I think, the palæontological speculations, but rather the proof—and I think I may say that Mr. Gardiner has given a definite proof—of the great depths at which currents can produce an effect upon the floor of the ocean. I remember very well the great impression that was

made when Sir John Murray demonstrated that the Wyville Thomson ridge, at the depth of about 250 fathoms, was swept clear of mud by the currents of the ocean. It was formerly supposed that no action disturbing the floor of the ocean took place below 100 fathoms; the discovery of the Wyville Thomson ridge showed action at several hundred fathoms, and now it is shown that mud and sand are swept away at 1000 fathoms, and that is a fact of real importance. Whether in the past the equatorial tides have produced much greater forces than are now at work, I do not know, nor do I think that I greatly care. There is still so much to find out about the condition of things at the present time that I appreciate Mr. Gardiner's solid addition to our store of facts. I was distressed to hear the Hydrographer say that the current-meter had not been sent down to great depths. One valuable result of the work of the International Council for the Study of the Sea has been the great improvement of oceanographical instruments, including the current-meter, and all forms of apparatus are now far better than those in use at the time of the *Challenger* Expedition. Mr. Gardiner was provided with one of the best forms of current-meter, and I must own that I was disappointed to see the instrument looking so clean and new as it lay upon the table in the other room. I think that in future, before sending out any expeditions, we want more preliminary study and more scientific guidance in the provision of all the apparatus that could reasonably be foreseen to be required. I hope that the time is coming when we may have oceanographical expeditions fitted out for the sole purpose of research. I know the magnificent services that have been rendered to science by the Navy in its hydrographical surveys, but oceanography has gone beyond the needs of the Navy into the deep waters outside those that must be charted for any purpose of navigation; it has gone into a region at present interesting only to scientific men where only a purely scientific expedition, with ample money given openly and solely for scientific purposes, can advance it. When we see how much can be done under conditions that, while favourable, are not perfect, we cannot help feeling how much more will be done in the future when the Government of the country, and perhaps even the scientific societies of the country, fully realize the importance of doing this work. I think Mr. Gardiner must be congratulated on having given us a most stimulating paper, and one that has given rise to a livelier and pleasanter discussion than I have heard in the Society for many years.

Dr. Gadow: I can only speak as a zoologist, but still a few words from the zoological point of view may not be amiss, if only for this reason—that zoologists are responsible for having advanced this problem of the connection between South Africa and India. This supposed land connection naturally implies the fate of islands like the Mauritius and Seychelles, and I think the way in which zoologists about forty years ago used to set about to prove this connection was rather what we would now call crude. It was based upon the well-known fact that in Africa and India existed a number of well-known types of animals like lemurs, rhinoceros, pittas, etc., and when it happened that fossil hippopotamus were discovered in Madagascar and in India, this was looked upon as proof positive of the correctness of the former existence of "Lemuria." But then it came to pass that one understood that it was easier to account for the similarity of the fauna of Africa and India in another way, namely, by assuming that the centre of dispersion was somewhere in Eurasia, whence similar or closely allied creatures spread into Indo-Malaya and into Africa, whilst in the northern parts the originals died out. However, zoologically, there are quite a number of creatures which suggest very strongly that such a connection must have existed, not only in the bygone periods of Mesozoic times, but even in the Tertiary, perhaps as late as the Miocene, period.

For instance, if you take the amphibia of Madagascar, you find that they have a very strong resemblance, which cannot be accidental, with those of India and Malaysia; and, what is stranger still, the amphibian fauna of Madagascar has more affinity with Malaysia than it has with South Africa. We have now to sift our material more carefully than has been done until recently. The absence in Madagascar or in India of certain groups of animals is just as important a feature as the presence of others. But one good fact goes a long way, much further than many speculations. Mr. Gardiner showed us the photograph of a tortoise. Now, such gigantic tortoises existed, not only in Aldabra, but in Madagascar and still further east, in Mauritius and Rodriguez. These land tortoises are such well-defined forms that it is almost certain that this type cannot have been developed independently in different countries. Moreover, they are so absolutely terrestrial that wherever we find them, unless where they have been brought artificially by man, these tortoises must have got there by land. So far as I know, there is no fact brought to light as to the distribution of animals or plants which is dead against this idea of the Africa, Madagascar, and India connection, a connection, I insist, which must have lasted right into the middle of the Tertiary period. There is nothing against it. There is strong reason to compel us to think that it existed. Now, curiously enough, it seems that from the oceanographer's and from the geologist's point of view, Mr. Gardiner feels certain that the connection existed, but that even with these newer and more exact methods he fails to prove his point. As a zoologist, I think we ought to be grateful to him for giving us a hint of how to get out of the difficulty. We feel that disappearance of the land must be of comparatively recent date. The problem still stands, although we do not yet exactly know how to tackle it or bring forward definite proof.

The PRESIDENT: As we have not before us the æons of time that Mr. Gardiner can command for his phenomena, we must terminate our discussion now, especially as Mr. Gardiner has some replies to make to the points brought forward by other speakers. I shall, therefore, now propose a hearty vote of thanks to him for what, I quite agree with Dr. Mill, is one of the most interesting papers I have heard in this hall.

Mr. J. STANLEY GARDINER: I have, in the first place, to express my great indebtedness to you for the kind manner in which you have passed a vote of thanks to me, and also for the very patient way in which you have listened to-night, particularly since I am sure to be regarded by some as having been putting forward *crack-brained* theories. In spite of the lateness of the hour, there are one or two points to which I must refer. First of all, the question of deep-sea currents: it does not, as Dr. Mill pointed out, want a current-meter to prove their existence. The bottom deposit, or rather the absence of a bottom deposit, does give a definite indication, and these indications, when cumulative, give an absolute proof of the existence of such currents. There have been numerous soundings in channels between the islands of the Malay archipelago, many of which are so closed in as to be apparently unsuitable for the existence of such deep currents. I consider that the bottom characters, ascertained by these soundings, give definite proof of the presence of deep currents in that region, and make the existence of similar ones easily understandable between India and Madagascar. Further, I have not yet seen the contentions put forward by Mr. Buchanan in 1895 seriously contested with regard to the currents between the Canary islands.

I am particularly grateful to Admiral Field for coming and speaking. I am afraid I may have been in the past guilty of laying too much stress on the comparison of charts. I am accused of regarding Admiralty charts as being more correct than they really are, but Admiral Field should be the last to accuse me,

since my conceptions were derived from seeing his surveys in H.M.S. *Penguin* ten years ago. I was specially interested in the new soundings between Cargados and Mauritius. In one chart, prepared for the Maldive expedition, I joined these lands on purely theoretical grounds within the same 1000-fathom line. In a chart prepared for this evening, I separated them, in view of our soundings, and I am happy in now being able to include them again, as I think Mauritius and Bourbon must have been connected with the Cargados-Seychelles crescent.

The questions raised by Mr. Lydekker go very deep, and are scarcely suitable for consideration now. At this hour one cannot go into the question of the geographical distribution of animals and the very divergent views that people take about parallel and convergent evolution. He suggested that I was wrong in considering to-night the ocean between Madagascar and India by itself; but the expedition only explored that line, so I naturally confined myself to it. I quite accept a great deal of what he said, and of the considerations put forward by the late Dr. Blanford, who largely assisted me in the scheme for my expedition. I do not see why the subsidence which formed the bay of Bengal should have also disconnected Madagascar and Ceylon. I am sure most geologists will be agreed that the Madagascar-Australia connection was broken down long antecedent to that of Madagascar with India, the Bay of Bengal having then been formed. Now as to the question of the tortoises. How did they get to Aldabra? Aldabra must have been connected to Madagascar! Is this possible? It is a recently elevated limestone island, and we should have to imagine a complicated series of upheavals and subsidences in quite recent periods, making and destroying a bridge, but leaving a little speck of land peopled by tortoises. I confess that this supposition is to me incomprehensible, and I must fall back on such methods of marine transport as brought tortoises to the Chagos and lizards to so many lands. The question of the means by which such distributions were effected is a difficult one, and surely too complicated and detailed for discussion at this late hour.

NOTES ON THE GEOGRAPHY AND PEOPLE OF THE BARINGO DISTRICT OF THE EAST AFRICA PROTECTORATE.

By C. W. HOBLEY, C.M.G.

THIS district comprises an area of about 10,000 square miles, and was until the last few years one of the least-known portions of the protectorate, and it is on this account that it is considered that the following notes may interest the Society.

Personally, only a small portion of the district is known to me, and the bulk of my information has been collected from the reports of Mr. G. F. Archer, who has energetically administered it during the last two years.

Geographical.

From an altitude of 3325 feet at Lake Baringo the country drops steadily towards Sugota and Rudolf lake (1250 feet), where the heat becomes intense and the grazing-grounds are scorched by a withering

sun. About March or April torrential rains usually occur, and the numerous dry watercourses are transformed into great rivers—in a few days half the country is under water or converted into quagmires. The soil, however, is so sandy and porous that a few weeks later the water has all disappeared again.

Owing to this scarcity of water, there is little in the district to attract the European settler, and this area may be definitely looked upon as a native reserve; the only change might come from the discovery of minerals, but the very recent volcanic formations of which the country is composed do not offer hopeful prospects. In spite of the aridity of

TURKANA CHIEFS AT BARINGO. AJIGWA THE GOVERNMENT CHIEF, ON EXTREME RIGHT.

the area, the grazing is declared by the natives to be marvellously good, especially for sheep; but, owing to the precarious water-supply, they are forced to adopt a nomad existence and move on from one water-pool to another. In some places they depend on brackish springs, and often dig wells in the dry watercourses to a depth of over 20 feet.

One of the most curious features of this region is the river Sugota, which, when visited by Mr. Archer in September last, was a rapid stream about 10 yards wide and 2 feet deep. It is hot and brackish, but drinkable in its upper course. It runs on northwards for about 70 miles without widening out in any way, and when it approaches the vicinity of the Andrew volcano, which is on its east bank, suddenly disappears into the ground. North of this point there are great flats covered with

TURKANA, SHOWING HEADDRESS.

deposits of natron (the magadi of the natives), and in the middle there is a small lake fed by two small streams from Mount Nyiro.

The enormous Lake Sugota of the Intelligence Division map, No. 1429 (*d*), is non-existent, and it is difficult to understand how it became delineated. The Sugota river is bounded by great walls of lava, so could hardly have flooded the plains. It, however, may be that Cavendish or one of the earlier explorers saw the whitey natron deposits from the slopes of Mount Nyiro, and took them for water.

There are also natron deposits higher up on the Sugota river, at a place called Pirias, and at this point the stream becomes quite undrinkable, and, according to native account, if camels and sheep drink it they die in a few minutes.

The native accounts of the Andrew volcano are rather interesting. They are firmly convinced it is the home of Engai (a Masai word meaning "God"), and are afraid to approach it closely. Strange rumbling and hissing noises are continually heard in the vicinity; the ground all round for several miles is broken up by great fissures in which boiling water is visible; and, most appalling of all, frightful cyclones pick up objects near the mountain and carry them into the crater. When these occur, the Turkana say they huddle together on the ground, and their spears and shields are often carried away; they laughed at the idea of a European being able to pitch his tent anywhere near, and said it would be swept into the crater like a herd of their camels had been a year or two ago. The essence of all this farrago

is that the volcano is probably only approachable from the east side, on which occurs the only fresh water which is to be found in that locality.

A rough analysis has been obtained of the water of the Sugota river, and it is said to contain the following salts: Sodium sulphate, magnesium chloride, sodium chloride, potassium chloride, calcium carbonate, traces of iron. It also gives off odour of sulphuretted hydrogen after keeping.

The country bordering the upper part of the Sugota river, though intensely hot, is very pleasant to the eye, a profusion of palms taking the place of the ubiquitous sansevieria aloe; lines of magnificent wild date palms mark the course of the river, and the broken jagged lumps of lava which are strewn over so much of this country gives place to hard sandy soil, which renders travelling pleasant.

SUK: TABOLAY, KAMUTA, SAGWALAN.

Native Tribes of the Baringo District.

Five tribes are represented in the Baringo district, for, besides the Suk, Turkana, and Njamusi, there are sections of the Kamasia

TURKANA FIGHTING MEN COMING TO CAMP TO PAY THEIR RESPECTS.

and Elgeyo peoples, and it may be of interest to trace the history of the people inhabiting this stretch of country during the last half-century.

Originally the whole of the valley from Lake Baringo to Loroghi was occupied by the Samburu, but, being frequently molested and raided by the Elburgo Masai, they gradually trekked away north to the neighbourhood of Mount Nyiro for safety. The country was then left uninhabited for a while, till the Suk—an offshoot of the Karamojo, and not of the common Laikipia stock—who till this time had confined themselves to the country to the north-west of the Kerio river, began to work southwards, and were followed by the Turkana from Lake Rudolf. These two tribes came right down to Lake Baringo, the Suk keeping more or less to the western side, and the Turkana to the east, with the Ribkwa escarpment as the dividing-line between the two, and after a while made a combined attack upon the Njamusi (a numerous people living at the south end of the lake), which was successful; then, however, they quarrelled amongst themselves, with the result that the Turkana, in trying to get rid of the Suk, were beaten themselves, and had to return whence they had come, leaving the Suk in possession of the country and large herds of their cattle and sheep.

The raid on the Njamusi must have taken place about forty years ago at Lakasissio; the old chief of Njemps was then a "laioni," and is interesting as showing that at that time the Turkana were occupying the very part of the country to which they are now anxious to return.

The Suk, however, suffered much at the hands of the Masai after this, and to this day still cherish unpleasant memories of the Morans of Ongatabus. To this fact, however, is due in a great measure their attitude towards Government, which they now have come to look upon as a benefactor in preserving them and their stock from these raids, and also their willingness in paying up their hut tax, for they realize that if the Masai had been allowed to continue in their predatory habits, and the Government had not stepped in to offer them protection, by this time they would have very little left. They admit they cannot stand against the Masai, though of the Turkana, curiously enough, they have but little fear.

Turkana and Suk.

The range of the Turkana at present extends from just north of Labur, on the north-west side of Lake Rudolf, to the north end of Lake Baringo, a distance of some 250 to 300 miles. On the west side the tribe is bounded by Karamojo to the north and Suk to the south;

CORACLES ON LAKE BERINGO.

on the east by Lake Rudolf, Mount Nyipo, the river Sugota, and the Loroghi mountains.

The Turkana are, numerically speaking, very strong, and one section alone, the Tuo, I am told, considerably outnumbers the whole of the Suk pastoral people.

The subdivisions of the tribe are as follows:—

Section.	District.	Chief.
Ngolio	Kerio	Onameri. Mutellili.
Kotonya	Kerio	Katodi. Ajigwa (Govt. chief).
Ataacha	Kerio	Apuche.
Ngaboto	Dorobo of the upper Tirkwell	No recognized chief.
Ngamatak	Tirkwell	Ngamatak. Rioball ("Tumbo" of the Swahilis).
Nisir *	Tirkwell	Lobwin.
Tuo *	,,	Akeno.
Apacheros	Tirkwell, near Naremet, Lake Rudolf.	
Ceyagwara	Tarash	Engelecha.
Herimong	,,	Unknown.
Ngur	,,	,,
Nisir	,,	,,
Lukumomong	,,	,,
Atokomemwa	Labur	,,
Nisigar	,,	,,
Kalabong	N.W. Lake Rudolf	,,

From this it will be seen that there is no one paramount chief, nor, so far as can be ascertained, is there a Laibon. Lokorechum, an Ngolio of the Kerio who died about two years ago, is said to have been the last of the medicine men.

The Suk have only three subdivisions, viz. the Kasawarie, Lagit, and Kajiribkwa, and of these the first is by far the biggest. Lagwalan, Kamuta, and Karorlay, the three Suk chiefs of the Baringo district, are all Kasawarie; Lotonyalli is the chief of the Legit, and Aribomoi of the Kajiribkwa. With regard to the customs of the Suk and Turkana, it may be well to point out, to begin with, that these two tribes, particularly the latter, are exceedingly moral, and I do not suppose that there has ever been a case of a Turkana woman joining a trader's caravan when in the interior.

* Living together they form practically one big section, the most numerous and powerful in Turkanaland.

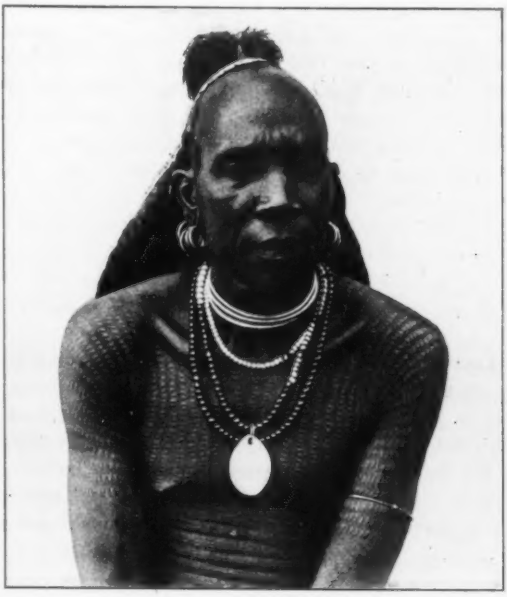
In the matter of the purchase price of a woman, it is interesting to note the difference between the Turkana and the Masai, for instance. A Masai pays as an outside price a cow or two, probably a few sheep; a Turkana a hundred head of cattle, ten camels (which are valued higher than cows), and droves of sheep. The reason given for this is the scarcity of women in Turkana, a fact largely attributable, it is imagined, to Abyssinian raids and oppressions. Those men, however, who can afford the luxury of a wife are well pleased with their investment, for in their own words, "our women are more prolific than dogs," and children to them mean wealth. Compare this, again, with the Masai tribe, who, on account of the comparative sterility

NJEMPS KUBWA. FIG TREES UNDER WHICH JOSEPH THOMSON CAMPED.

of their women, are believed by some to be on the road to extinction. The Suk pay nothing like so large a price for their women, though a rich man may pay as much as twenty head of cattle. An ordinary price is three or four cows and thirty sheep.

Of all serious offences amongst the Turkana adultery ranks first evidently, for the penalty, as a general rule, is death by spearing. In exceptional cases, however, when a man is very rich, the confiscation of every single head of stock he possesses is considered sufficient punishment. Amongst the Suk confiscation of all property is the invariable rule, and the hut, or manyatta, of the offender is also burnt to the ground.

Cases of murder seldom or never occur amongst either tribe, long



TURKANA CHIEF.

curved sticks only being used to settle differences where amongst the Masai spears or knobkerries would be the order of the day. In the event of murder, however, being committed, it becomes simply a matter of compensation in stock to the murdered man's brother or next of kin, final decision in the matter being left to the elders of the tribe.

The only other customs worth mentioning, perhaps, are the various methods of making peace amongst these tribes. The one in which the dog appears is common to several other tribes in East Africa, among which are the Bantu Kavirondo, the Nandi, and the Elgeyo. In this case the leaders of the two parties concerned grasp respectively the fore and hind legs of a sacrificial dog, along the back of which is laid a wisp of grass. A sharp spear is then used to cut the dog in two, during which process the chiefs cry aloud, "If my people do anything to your people, so shall God do to me," or words to that effect. This is absolutely binding and ensures a *bonâ fide* "amen." Why the dog should be selected as the victim is not clear. The general method employed in Turkana, however, is simply the exchange of sticks between the chiefs, on which are bound solitary long white ostrich plumes. Another method is for two spears to be laid on the ground parallel, when all concerned, if they wish for peace and friendship, walk between them.

It is commonly supposed that the Suk and Turkana, from a general likeness of appearance, are akin, but this is not proved, and it is curious to note that the Turkana say they are more nearly related to the Masai; and the Masai declare that the Turkana are the survival of the Laikipikiah section of Masai. The latter statement is, however, undoubtedly an exaggeration. The Turkana, moreover, do not circumcise, which may be taken as evidence that the two tribes are not very closely allied.

Their adopted country of burning sand, scant vegetation (acacia scrub and aloes), and salt water, however, seems to have agreed with them, for they are for the most part enormous men, and their women, too, are tall and well set up, and very different from the undersized Suk women.

Their kraals consist of a zeriba of bushes containing a number of temporary shelters of palm leaves and grass; these seem to be put together more as a protection against the sun than rain, for they are not in the least weather-proof. Two of the principal features of the kraals are the number of donkeys and children to be seen.

The women and children seem to be fearless, and usually come out and dance to meet a traveller whose *bona fides* they are assured of.

TURKANA CHIEF.

Their dancing is the same as the Suk, and, when the men join in it, is really rather a fine spectacle, for with their huge "chignons," waving plumes of black, white, and orange-dyed ostrich feathers, and their yellow clay-bedaubed faces, they present a fantastic and war-like appearance, and one realizes that here at least one is among really unsophisticated natives.

They are very rich in stock, with numbers of camels (which, however, they do not know the use of as draught or riding beasts), cattle, sheep (the white-bodied black-faced variety), and numbers of donkeys, which run about more or less wild and quite unattended. These donkeys go out in the morning to their grazing-grounds and come back again at night, sleeping anywhere near the kraals in the open. The surprising thing is that they are not the prey to troops of lions, but the Turkana say that if a lion gets amongst them at night, so far from stampeding, all the others go to the rescue, and generally the remains of the intruder are found in the morning kicked to pieces.

They will sell their sheep and male donkeys for trade goods or cattle, but are most averse to parting with their camels or donkey mares, as they use them for milking. Male camels are often killed for meat. They have no idea of using the camel as a beast of burden.

One has read much about giant Turkana, and there is not the least doubt about it, the men, generally speaking, are enormous, for if they are not invariably tall they make it up in breadth. They are literally twice the size of Kikuyu, and weigh, I should think, on the average very nearly double as much. What struck me most, however, was the size of quite young "Laionis," who have great thighs and hips just as big as full-grown Suk, and their bones seem extraordinarily big.

RUWENZORI AND THE FRONTIER OF UGANDA.

By DOUGLAS W. FRESHFIELD.

His Royal Highness the Duke of the Abruzzi, who has paid a visit to London since his return from Africa, has promised to offer a paper to the Society on his recent ascents in the Ruwenzori Range, of which he has made the complete conquest, having climbed the twelve highest snow-peaks, which all stand in a close cluster within a radius of a few miles; none of them, he tells me, exceeds 17,000 feet. The paper will be read in January, and will be illustrated by a number of Signor Vittorio Sella's photographic panoramas and views, which completely elucidate the topography of the upper region above the snow-level. Further details of the meeting, at which His Royal Highness expects to be present, will be duly announced to Fellows.

Dr. Wollaston, a member of the party sent out by the Natural History

Department of the British Museum to explore the Ruwenzori region, has sent home a letter, which contains the following account of his failure to reach the snows from the west:—

"I think I told you in my last letter that I hoped soon to get round to the west side. After many difficulties and delays, we arrived at Fort Beni, the Belgian post on the Semliki, about the middle of July. From there we set out with an escort, which the Belgian officer insisted on our taking—and which proved the cause of our undoing—and made the Butagu valley in three days. I left the party camped at 7000 feet (Kakalongo, in Stuhlmann's map), and started full of hope for the upper parts of the valley, with ten porters, a camera, and your old Himalayan ice-axe. A good but very steep track, accurately marked in Stuhlmann's map, took me up to 11,000 feet, and I was just leaving my second camp, with only a short march ahead, when a message came from below that a detachment of the escort had been attacked a mile or two below our camp (at 7000 feet) by natives armed with guns; one soldier killed and five wounded, two fatally. My services were required to bring them together again and my porters to carry them, so there was nothing for it but to go downhill as speedily as possible. As we retreated down the valley on the following day—the day on which I ought to have been within reach of the glaciers and taking photographs of immense interest—the snow-peaks were all clear, as if to spite me, for an hour or more after their usual time, and I saw some superb views. It was impossible to take photographs, as we were dodging spears and arrows all the time; in fact, it was a sort of running fight for three days all the way back to Beni; a good many natives killed, but none of our people badly hurt. It was, I think, the cruellest disappointment I have ever known—to be within half a day's journey of one's most coveted goal, and then to be compelled to turn one's back upon it. The root of the evil lay in the Belgian who had charge of the escort. In spite of protests, he camped in the natives' gardens, cut down the shambas, at one place shot the village cow, while his soldiers looted the houses. In return for these barbarities, they rose up against him, and we suffered for it. I am convinced that, had they let us go without escort, we should have had no trouble at all. When we left Beni a week ago, they were preparing a punitive expedition to quell these wretched people, and will doubtless make bad worse. So until all the natives have been killed off, or until the Semliki becomes the Uganda boundary, the west side of Ruwenzori will not be a very wholesome place for a white man.

"The rare views that I got of the range from the west show it to be much finer than from the east, as one would expect, the Semliki being only about 2900 feet at Beni. There is a very fine valley I looked into (Russirubi in Stuhlmann; Paka is the name I got for it from a native thereabouts) which leads up to the snow on the northern slopes of the highest peaks, I should imagine. No European has ever

been into it yet. I confess that I am more than ever anxious to come back at the earliest opportunity; and this is a valley that would be well worth exploring. The Belgian Dr. David went up the Butagu valley, but how far he went I have been unable to find out.* I found the relics of an English pair of breeches at 10,000 feet—perhaps Scott Elliot's of 1894. Stuhlmann's photograph is of the highest peaks looking a little north of east.

"The two northern peaks must be those that I saw north-north-west from Kiyanja. Those to the right of the picture are the snow-peaks seen north-west from Kiyanja; they are all part of the same mass, and they run from north-east to south-west. From Beni, almost due west, I got a clear view for a few moments, and saw a large mass of snow to the north of the highest peaks, but not I think connected directly with them; probably on the far side (right bank) of the Russirubi. The highest peak cannot be much over 17,000 feet. This rough chart is as accurate as I can make it in my present state of ignorance. Probably by the time this reaches you, you will have got the Duke of the Abruzzi's finished map, and mine will be found wanting in many important points. I hope the Duke will find some good native names for the highest peaks. 'Birika' (boiling-pot) is the only name I heard on the east side for the snow.

"I have a photograph of 'King Edward's Rock,' taken from above Bujongolo, which shows it as evidently the lowest point of the Mubuku ridge. This expedition comes to an end at Entebbe in a few weeks, then I am off to the volcanos Mfumbiro, at the south-west of Lake Albert Edward.

"If you think any extracts from this are of sufficient interest for publication, please send them with apologies. Writing in this forest of pygmies and okapis is none too easy.

"Believe me, yours truly,

"(Signed) A. F. R. Wollaston.

"Approximate height of peaks—

Highest peaks	17,000–17,200 feet.
Duwoni	15,893 „
Kiyanja	16,379 „
Peaks north-west of Kiyanja	16,700 „
Big Snow	16,000 „

"I shall be interested to hear how near these are to the Duke of the Abruzzi's heights.†

"A. F. R. W."

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* Is not the Russirubi the valley Dr. David visited? His route is described as north of Dr. Stuhlmann's.—D. W. F.

† The Duke of the Abruzzi informs me that his heights, when finally worked out, will differ but slightly from those obtained by Captain Behrens (see *Geographical Journal* for July last).—D. W. F.

FRENCH CONGO
CONGO FREE STATE
LADO ENCLAVE
R. NILE
LAKE RUDOLF
UGANDA
LAKE VICTORIA
EAST AFRICA PROTECTORATE
GERMAN EAST AFRICA
LAKE TANGANYIKA
Lake Albert
Lake Albert Edward
Lake Kivu
Nile
Semliki
Victoria Nile
R. Kagera
Mt Ruwenzori
Mt Mfumbiro
Mt Elgon
Mt Kenya
Mt Kilimanjaro
Kibo
Kimawenzi
Mt Meru
Scale 1:10000000 or 1 inch=158 Stat. Miles.
100 50 0 100 200
1000 Sq miles.
Theoretical Treaty Boundary as defined by Treaties of 1.7.90 and 12.5.94.
Best natural boundary.
Present position 30th Meridian.
26
28
30
32
34
36
38
40
4
2
0
2
4

Having regard to the pending question with respect to the frontier of Uganda and the Congo State, alluded to in Dr. Wollaston's letter, the following explanation may be opportune. In order to make the facts intelligible a map, such as that here supplied, is essential. It will be observed that from the north end of Lake Albert to 1° N. of the equator the British frontier has been drawn along the edge of the great escarpment, leaving the slope draining to the Nile to the Uganda Protectorate. From this point to 1° S. the 30th meridian of E. longitude was in 1894 taken as an approximate and provisional indication of the situation in which a definite frontier might be delimited at a future date. This arrangement was embodied in an agreement between the Congo Free State and the British Government dated May 12, 1894.

Beyond 1° S. the Uganda frontier had already been regulated by the Anglo-German treaty of July 1, 1890, the terms and conditions of which were recognized on behalf of the Congo State in the later document. Between the Indian Ocean and Lake Victoria the frontier had been deflected north in order to give Germany the Kilimanjaro highlands; in return, it was deflected south to give Great Britain the well-defined Mfumbiro highlands south-west of Lake Albert Edward, first discovered by Speke and afterwards seen by Stanley. In 1894 this term, Mfumbiro, was in use, on the authority of Dr. Stuhlmann, for *the whole* of the volcanic region forming the watershed between Lake Kivu and Lake Albert Edward, and it was well known to geographers that these highlands lay, for the most part, west of the position *then* assigned to the 30th meridian east of Greenwich.* There appears, therefore, to be no room for dispute as to our frontier south of 1° S. lat., which should occupy the position laid down on the accompanying map. In this district, therefore, British territory extends considerably beyond the 30th meridian.

Since 1894 a discovery has been made which has apparently led to some needless doubts with regard to the western frontier. It has been found that the 30th meridian east of Greenwich does not lie in the position previously assigned to it on all maps of Africa, but some miles farther east. In consequence, in place of intersecting Lake Albert Edward and the Ruwenzori range, it runs wholly east of the former, and east of all but a portion of the north-west extremity of the latter. It can, however, hardly need to be stated that in considering the terms of the agreement of 1894, every competent statesman must accept as final the position given to the meridian on maps of that date, the only one that could possibly have been in the minds of the parties. The frontier is, in fact, indicated in that position in the sheet 3 of the "Carte de la Province Orientale Nord et du District de l'Aruwimi," on

* See *Mitteilungen von Forschungsreisenden und Gelehrten aus der Deutschen Schutzgebieten*, vol. **48**, Heft 1. Das Volkangebiet des Centralafrikanischen Grabens von Hauptmann von Herrmann. With map.

the scale of 1 : 1,000,000, bearing the imprint "État Independent du Congo," and the date 1904. Yet, despite this fact, the British Government have, as I learnt on the spot, temporarily withdrawn their outposts from the territory west of the newly assigned position of the meridian, and, consequently, their protection from tribes which had enjoyed it for more than ten years.

This frontier was, admittedly, a provisional frontier. The maps of that date were by no means a blank in the district in question, but the details of local topography were obscure and the relative importance of the distinctive features uncertain. The negotiators were not, or thought they were not, in a position to decide finally whether a mountain crest or a river course, or possibly a combination of the two, might furnish the most convenient line of demarcation. In these circumstances they left the matter to be settled at a later date.

The extensive knowledge of the district gained in the last twelve years, has shown that no line can be satisfactory that bisects the Ruwenzori range, the intricate valleys of which are inhabited by closely connected tribes. Moreover, history shows that, as a general rule, a frontier region is peculiarly liable to disorders where among primitive peoples it runs through the heart of a chain. In the instance under consideration, an arbitrary and imaginary line cutting first across the plain on the right bank of the Semliki and then transversely across innumerable forested spurs, must prove a most undesirable boundary. The time has now come when a frontier can readily be drawn in accordance with the physical features of the country. Nature has provided a natural boundary in the Semliki river. It should be adopted. It has been recognized that Lake Albert is wholly British. But it may not be found impossible to compensate the Congo State for any loss of territory on the right bank of the Semliki by a corresponding grant west of that stream.

At the present time a Congo State "Geographical Expedition" is working along the boundary in question, and it is understood in Uganda that a British Survey Commission will shortly visit the district. It is of the greatest importance that its instructions should allow it to survey and thoroughly examine all the country as far westwards as the frontier lines shown on the accompanying map, whichever of them may happen to be the farthest west. Unless this is done, His Majesty's Government will not have the full knowledge of the local topography necessary in order to arrive at a final and satisfactory arrangement.

The boundary lines shown on the German frontier indicate, where they diverge, a possible "give-and-take" which would bring the frontier into closer connection with natural features, and thus prove advantageous to both parties. This, however, is a matter for separate consideration.

COAST EROSION.*

I. By CLEMENT REID, F.R.S.

ANY one living on our sea-coasts, or even visiting them, must have noticed the rapid waste of the cliffs under the attacks of the sea. This waste is particularly noticeable in the east and south of England, and it will therefore be most useful to confine our attention to those regions.

We notice the melting away of the land, and we naturally think of it as a steady process—intermittent, it is true, according as the season is more or less stormy, but varying little when the average is taken for successive groups of years. Closer study, however, compels us to recognize that the changes now in progress are by no means confined to a continuous attack of the sea on the land. There are compensating, but less conspicuous changes, such as the accumulation of shingle-beaches and sand-dunes, and the silting up of our estuaries. There are unexpected geological complications which should lead us to pause and consider before we say that the loss is an unmixed evil and should be stopped. It soon becomes clear that the whole of the changes now in progress on our coasts must be studied together, and that we cannot separate the loss of land from the other phenomena which accompany it.

If we study the physical geography and geology of the region, noting the outline and cross-section of the coast, measuring its annual rate of loss and the annual rate of accumulation, we soon arrive at a somewhat unexpected result. We learn that there was a definite date at which the changes now in progress began. We find not merely that we are losing annually a strip of land of noticeable width, but that the whole character of our coast-line is altering.

The process is not very conspicuous, it is true, in a single generation; but if we read the geological history carefully, its importance is far greater than we had imagined. The Britain that Cæsar invaded was very different in its coast-line from the Britain of to-day; the Britain of three thousand years ago was still more unlike. Not only has the coast receded; it is becoming less indented by navigable estuaries and harbours, and the existing harbours are rapidly silting up. Our cliffs, also, are nearly everywhere becoming higher and more conspicuous.

In order to understand the nature of the changes that are now going on, it is necessary to look back some three or four thousand years to see what the country was then like, otherwise the existing irregularities of our coast-line will be unintelligible. I do not propose to go back further, for it is not necessary for our present purpose to deal with any period earlier than that of Neolithic man, when the sea stood about 60 feet below its present level. This statement may seem somewhat dogmatic, but space will not permit me to give in detail the evidence. I can only say that a close study of the buried land-surfaces, found in the alluvium at various depths down to about 50 feet below the sea-level, shows that oak trees flourished on the lowest of these ancient soils. This proves that the sea then stood so far below its present level that no sea-water could reach the roots of these trees.

This former low level of the sea has consequences that are not generally realized. During that period the seaward end of each valley was lowered by the scour of its river, till the valley-bottom near the coast reached the sea-level. Consequently the greatest depth of every one of these channels will be found at a level about 60 feet below the present river bed, though of course its exact position may not coincide with that of the present channel. We cannot say for how long a period the land stood

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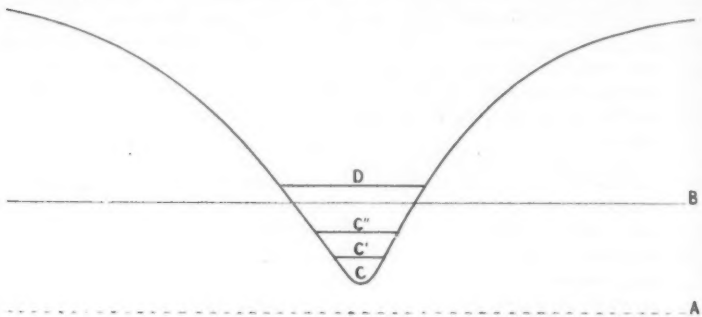
* British Association, Sections C and E, York Meeting, August 3, 1904.

at this high level, for this part of the geological record is unfortunately still somewhat obscure. The period was, at any rate, sufficiently extended for the V-shaped sections of these valleys to be well developed (see Fig. 1). Engineers must remember the existence of these buried channels in any designs for docks occupying estuaries; the channel is sure to occur, and its exact position may be of very great importance, when it is a question of works that need a solid foundation. The channel is usually narrow, but it is filled with loose alluvial deposits.

Thus far I have only spoken of the deepening of our river-channels, and it may be asked, What connection has this with coast-erosion? Theoretically, it may have little connection; but, owing to peculiar conditions, the relationship in Britain is a most vital one, and I will explain in what way. When the sea stood at a level 60 feet lower than now, most of our coast was fringed by a belt of low ground, extending out approximately to what is now the 10-fathom line. On the landward



A. Ancient sea level. B. Modern sea level. C, C', C'' Submerged forests indicating successive stages in the subsidence, and in the filling up of the valley. D. Existing alluvial flat.

FIG. 1.—DIAGRAM SECTION ACROSS A SILTED-UP VALLEY.

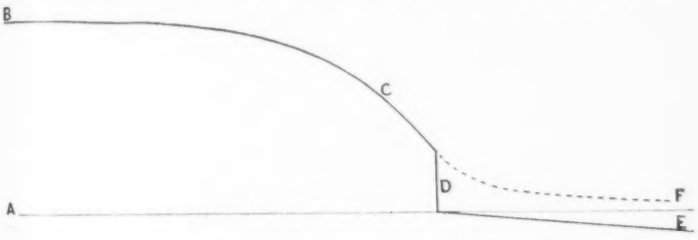
side of this belt was, and in many places still is, a steep grassy slope, representing the position of a still more ancient line of cliff, the face of which has been hidden by rubbish washed from the slope above. The south and east coast of England, at the period with which we are dealing, must have been utterly unlike what we now see. Instead of bold cliffs, there was this wide coastal plain, like the plain which still extends for many miles west of Brighton, reaching a width of 8 miles at Selsey Bill.

About four thousand years ago there set in a fairly rapid, but intermittent subsidence of the land, or rise of the sea; we do not yet know which it was, but for practical purposes the effect is the same. This rise of the sea-level flooded a great part of the coastal plain, and brought the waves within striking distance of the rising land behind. It also submerged the lower part of all our valleys, turning them into winding sea-lochs, or fjords, which penetrated far into the land.

The question may be asked, Why do I say that this process was both rapid and intermittent? As a follower of Lyell, I perhaps ought to say that it was gradual and almost imperceptible. However, the facts are stubborn things, and the geological evidence seems clearly to prove that the process was more rapid and more jerky than any change which has been recorded of late years. We cannot go fully into the evidence, but a close study of the alluvial material and old buried land-

surfaces which now fill so much of these valleys leaves little doubt. All our big submerged valleys tell the same tale, whether it be the Humber, the Wash, the Thames, Southampton Water, the Severn, or the small Cornish rivers whose buried channels have been so thoroughly mined, far below sea-level, in the search for stream-tin. Wherever we can see the deposits, sift, wash, and examine them, or wherever careful records have been kept, we find masses of rapidly deposited marine silt, alternating with beds of peat and thin soils in which trees are rooted. But the vegetation is usually nothing but brushwood or quick-growing trees, and the peat also is of rapid growth. Only at the very bottom, far below the present sea-level, have I seen oaks of more than a hundred years. Usually the evidence suggests the rapid accumulation of warp to the level of high water, then a few years of peaty swamp or alder car, followed by another subsidence, and the accumulation of more warp. And so the process goes on through the whole 50 or 60 feet of sediment deposited in the silted-up parts of the estuaries.

This rise of the sea-level may have been completed about 3500 years ago, at about the date when Stonehenge was being built. Whatever may be its exact



A. *Sea level* B.C.D.E. *Present contour.* (B. *Plateau.* · C. *Slope.* D. *Cliff* E. *Plain of marine denudation.*) F. *Coastal plain (now destroyed.)*

FIG. 2.—DIAGRAM SECTION SHOWING SEAWARD SLOPE LEADING TO THE COASTAL PLAIN, OR, WHERE THAT IS DESTROYED, TO THE EDGE OF THE CLIFF.

date, the completion of this rise is the starting-point for our present inquiry. Only then commenced the coast erosion which we now see; only then did our existing shingle-beaches and sand-dunes begin to form.

At first erosion must have been rapid, for the sea was merely eating into loose talus, or into cliffs of little height, and protective banks of shingle and sand take time to form. But as the land was cut into, these loose masses were steadily removed and their harder parts were rolled into shingle-beaches, which greatly protected the coast. The cliff also became higher as it was cut back. In short, everything tended, and still tends, to make the width of the strip destroyed annually less and less.

Many may be surprised when it is affirmed that all this can be read in the contours we meet with all round our coast. A section drawn across the coast to the sea in the east and south of England shows nearly always the same feature. It does not exhibit the sea eating into a tableland; it usually shows a plateau ending seaward in a long slope, which slope is steadily being cut into by the sea. The cliff is not nearly so high as it will be a thousand years hence, and it is far higher than it was at the date of Cæsar's invasion (see Fig. 2).

This brings us to the rate at which the loss has taken place since the sea stood at its present level. It is very difficult to obtain trustworthy data, but, roughly,

the loss for the coast south of Flamborough Head to the Thames seems to average about a yard a year. Not only is the land eaten into, but the submerged coastal plain is steadily eroded by the scour of the tide during storms; so that sites of ancient towns, like Shipden on the Norfolk coast, are now covered by several fathoms of water. Coast erosion does not cease, as is sometimes thought, at the sea-level; it continues to whatever depth a strong current combined with wave-oscillations can be felt. This submarine scour is particularly strong close to the coast, where the tidal current is often confined to a definite channel between the coast and sandbanks outside.

The importance of the submarine scour need not be dwelt upon; but I may mention a striking instance of it noted nearly thirty years ago on the Norfolk coast. A gale of exceptional violence, with a north-west wind and a spring tide, drove the water into the North sea, so that the flood-tide ran like a mill-race past the projecting coast. The loss of land was exceptionally great during this gale, more going during a few hours than the average for a year. The whole foreshore at low tide was seen to be ploughed into deep channels parallel with the cliffs, and other similar channels were cut out well below tide-level. Heavy slabs of ironstone were thrown up on the beach. I wished to ascertain the source of this ironstone, so took a boat and dragged for it a few days after the storm. We found the sea bottom quite altered. Normally there was nowhere a depth of more than 5 fathoms in the part examined; but we found 10 fathoms, and then the drag dropped off a submarine cliff into a hole of 15 fathoms. Taking the boat back across this channel, we were suddenly brought up by the grapnel we then used getting fast. I could not succeed in detaching a slab of the rock; but when at last the grapnel was cleared, it was found to be bent back, its point having played against a ferruginous rock like the slabs thrown up by the storm. This shows that the storm had been able to scour to a depth of at least 15 fathoms, not only in loose sand, but in strata containing slabs of hard rock. A few months afterwards nothing could be found but the ordinary shallow sea with a gravelly and sandy bottom.

We must not forget this submarine scour when we talk of building sea-walls or high groynes on a coast where there is no solid foundation, and where, to add to the difficulty, there is a high cliff of loose material with a base of loam or quicksand, so that the cliff is ever moving slowly and almost imperceptibly seaward. I have seen several generations of groynes and sea-walls built and destroyed on stretches of coast where these natural conditions have been ignored.

We will next inquire what becomes of the land thus lost, for there are compensations. The coarser material in part is washed into deeper water and lost; but much of it is piled into shingle beaches, which form our best barrier against inroads of the sea. The sand partly forms shelving beaches, on which the sea spends its force with little effect; or it is blown up by the wind into dunes, behind which large tracts of marshland may be preserved as pasture. Sandbanks and dunes have a protective effect which must not be forgotten: they enable valuable pasture to exist below the level of high water. Behind the banks the rise and fall of the tides may scarcely be felt, and dry land may exist only a little above the level of mean tide. Of course, if the erosion of the coast were stopped elsewhere, as it has been in certain places, shingle beach and sand-dune will themselves wear out and disappear, and the low lands may be left unprotected during storms.

Another compensation for the loss of land must be mentioned, though here all do not agree. I allude to the great gain of alluvial land in the sheltered estuaries, such as those of the Humber and Wash. It is often stated that the many square miles reclaimed during the historic period are merely the deposits from the rivers. To a certain extent this is true; but I have stood on Dimlington beacon after a

gale, when the Holderness cliffs had suffered great loss, and have watched the thick yellow stream that swept down the coast with the flood tide and rushed into the Humber. Here was an amount of mud carried in sufficient to add considerably to the marshes, as the particles were strained out by the submerged vegetation. We do wrong to neglect this source, especially when we see that certain of our harbours, which receive few or no streams, are yet silting up with great rapidity. To what extent the gain in these marshlands compensates for the loss on the coast, I cannot say, for exact measurements are impossible to obtain.

This silting up of the submerged estuaries, however, may be looked at in another way, and then it becomes a loss, not a gain. It means that many of our harbours are rapidly becoming useless, and that numerous arms of the sea, formerly navigable for miles inland, have dwindled to shallow streams flowing through alluvial flats or sandbanks.

Before we take for granted the desirability of attempting to stop the wearing away of our coasts (except near towns) we must strike a balance between loss and gain. On the one hand, we lose considerable areas of agricultural land, our sea-coast towns are injured, and our harbours tend to silt up. On the other hand, we gain considerable areas of valuable agricultural land—more valuable than the average of that lost, and through the accumulation of shingle beach and sand-dune we obtain protection for certain low lands which otherwise would be flooded and spoilt. If the loss exceeds the gain, there will still remain the question whether we shall obtain any sufficient compensation for the enormous cost of any works put up to protect agricultural land.

Some curious problems are suggested by this inquiry. Many may think them of no practical importance; but to the geologist and the geographer they are of great interest, and cry aloud for a solution. If what I have said is correct, and since civilized man lived in Britain there has been a rapid change of sea-level, followed by a long rest, what are the prospects of a similar period of rapid change again setting in? To answer this question, we must know whether it was the land that sank or the sea that rose, and what was the cause of the movement. We have had many speculations; but thus far we can neither explain the cause of the phenomena, nor predict future movements. It is a problem of great importance, for a new rise or fall of the sea-level to the extent of a few feet would have most disastrous effects on all our coasts and harbours, and would seriously interfere with our inland drainage until things were again adjusted. Are we now living in a period of exceptional stability, both of sea-level and climate; or is it, as geology suggests, a mere interlude which may at any time give place to rapid change?

II. By E. R. MATHEWS, A.M.I.C.E., F.G.S., Borough Engineer of Bridlington.

Mr. Mathews pointed out that no part of our coast was changing more rapidly than that line of coast that was situated between Bridlington and Spurn Point, which is known as the Holderness coast of Yorkshire. He said that this coast-line was scarcely the same for two consecutive days, and that this was easily accounted for by the fact that the material forming this coast consisted of glacial drift, which was more easily eroded than any other material. He pointed out that it had fallen to his lot to have to design and carry out for the Bridlington Corporation, in order to prevent the inroads of the sea, £30,000 worth of sea defence works, and for several years past he had made a special study of the erosion of this part of our coast, with the result that he was able to give certain information respecting it, the following table being a summary of same :—

SUMMARY re EROSION ON THE HOLDERNESS COAST.

Part of coast.	Formation of cliffs.	Distance.	Rate of erosion in yards per annum.	Height of cliffs.
Flamborough Head to Bridlington	Chalk for 3 miles, then glacial drift	5	0·5 yd. to 2 yds.	80 ft. to 130 ft.
Bridlington	Glacial drift	2	Protected	—
Bridlington to Barmston	,, ,,	5	3 yds.	10 ft. to 30 ft.
Barmstone to Ulrome ...	,, ,,	5	1½ yd. to 4 yds.	10 ft. to 20 ft.
Ulrome to Skipsea ...	,, ,,	1½	2 yds.	25 ft. to 35 ft.
Skipsea to Skirlington ...	,, ,,	2	2 yds.	—
Skirlington to Atwick ...	,, ,,	1	2½ to 3 yds.	30 ft.
Atwick to Hornsea ...	,, ,,	2	—	—
Hornsea	,, ,,	—	Protected	—
Hornsea to Hornsea Burton	,, ,,	1	2½ to 4½ yds.	30 ft. to 40 ft.
Hornsea Burton to Mappleton	,, ,,	1½	2 to 3 yds.	50 ft.
Mappleton to Aldborough	,, ,,	3½	2 to 2½ yds.	70 ft.
Aldborough to Ringborough	,, ,,	2	3 yds.	50 ft.
Ringborough to Withernsea	,, ,,	7	3 to 4 yds.	25 ft.
Withernsea	,, ,,	—	Protected.	—
Withernsea to Dimlington	,, ,,	5½	3½ yds.	—
Dimlington to Easington	,, ,,	1	5 yds.	—
Easington to Kilnsea ...	,, ,,	2½	3 to 4 yds.	—
Kilnsea to Spurn point	Sandhills	—	—	—

Mr. Mathews then gave the meeting some interesting calculations that he had made respecting the erosion on this part of our coast since the earliest times. And in quoting from a paper read by him before the Institution of Civil Engineers, he said that, assuming the average height of the cliff to be 18 feet, and the weight per cubic foot of the glacial deposit and boulder clay to be 120 lbs., no less than 1,904,194 tons of cliff are washed away annually. The erosion has been estimated by some engineers to be 3,000,000 tons per annum, but he thinks that the figures given are more correct. Further, assuming that a rate of erosion of 3 yards per annum has been going on for the past 'century, no less than 3052 million tons of cliff have been swallowed up during that time. As to area lost, assuming that 1 acre per mile of coast-line has been swallowed up annually, and that loss at this rate has been continuous, no less than 66,600 acres have been swallowed up by the sea since the time of the first Roman invasion under Julius Cæsar in the year 55 B.C. If the coast-line between Flamborough Head and Bridlington—5 miles in length—be added, and the rate of erosion of that part of the coast be taken at an average of 6 feet per annum, the loss is found to be $3\frac{2}{3}$ acres per annum, or 7180 acres swallowed up in the period named. This makes a total of 73,780 acres, or 115 square miles of land lost since the time of the Roman invasion, between Flamborough Head and Kilnsea (near Spurn Point), an area almost equal to that upon which London stands. Again, the average rate of erosion of the coast between Bridlington and Kilnsea is 11 feet per annum. Assuming that erosion since the Roman invasion had been continuous at the rate of 3 yards per annum, the sea has made an inroad upon the land during that time to the extent of $3\frac{1}{3}$ miles.

He then dealt with the abnormal erosion and destruction that had been done by the sea during the past winter, and referred to the flooding that took place in March

last on the Holderness coast between Easington and Kilnsea, when over a thousand acres of agricultural land was transformed into a series of lakes of salt water, which in some places were 8 feet in depth. He pointed out that Kilnsea for a time was a complete island, and illustrated this by a map which he produced, and which showed the point at which the sea broke through. Mr. Mathews pointed out what a serious matter it would be for the navigable channel up to Hull if the sea and the Humber made a permanent juncture at this point. He pointed out that such an occurrence was not altogether improbable, seeing that the lowlands that were flooded were in many places 6 feet below the level of the sea. He also stated that the erosion on the Holderness coast received considerable impetus during this and other storms which have taken place during the past winter.

He said that, although the huge lakes referred to soon disappeared, the withered and brown wilderness, with sea-drift scattered about, here and there a wrecked agricultural implement, told its own tale of what had only a few months ago occurred.

Mr. Mathews then gave some interesting information respecting the growth or diminution of headlands on the east coast. The growth of Spurn Point (Yorkshire) was one of the most remarkable instances cited. The position of Spurn, he said, was a variable one, and was constantly changing. He pointed out that it was built up largely by the eroded material from the Holderness coast, and consisted of vast quantities of sand and shingle, which were steadily accumulating. He said that at one time this was an island, and its connection to the mainland was a more or less gradual process. In 1660 the high-water mark extended just to the south of Kilnsea, Spurn being simply a heap of shingle, some distance to the south.

Collins, in his chart dated 1684, shows Spurn connected to the mainland, but it is difficult to say whether this was correct, as later surveys show Spurn to be still an island. From 1820 to 1852 Spurn was only an island at high water. In 1852, however, high water spring tides only submerged two places.

In December, 1849, during a north-north-west gale, a serious breach was made in this nich of land, about half a mile to the north of the then High Lighthouse. It was 320 yards wide, and at high water ordinary spring tides it had 12 feet of water in it. It was subsequently made good by the deposit of chalk.

Since 1852 Spurn has been well protected by groynes, and it is gradually extending to the south and west. Mr. A. E. Butterworth, the engineer to the Humber Conservancy Board, stated in a paper entitled "Notes on the Growth of Spurn," read before the Yorkshire Naturalists' Union in July, 1904, "that the westerly movement of Spurn between 1851 and 1888 has been at the rate of 8 feet per annum on the east or North Sea side, and 17 feet per annum on the west or Humber side, showing that the Point has increased considerably in width."

He next referred to Dungeness point (Kent) as being a remarkable headland, the growth of which seawards between 1689 and 1844, according to Mr. J. B. Redman, was at the rate of 7 yards per annum. He stated that the Trinity House records show the seaward advance of Dungeness point to have been at the rate of 9 feet annually between 1792 and 1850; 13 feet to 14 feet between 1850 and 1871; and 8 feet between 1871 and 1897. The lighthouse, he stated, had been shifted seaward three times during the last century. The vast extent of this shingle deposit may be gauged from the fact that at 100 yards from the shore at the point at low water there are 4 fathoms of water, and 330 yards from the shore at low water there are 15 fathoms of water. He then pointed out that the remainder of the headlands on the east coast were receding—Flamborough Head, which consists of chalk cliffs 80 to 130 feet in height, at the rate of 1·5 foot per annum; Lowestoft Ness (Suffolk), which is the most easterly point in England, the cliffs here consisting of glacial drift, and the beach widening at the foot of the cliffs, forming a broad

expanse of "denes." This point receded between 1854 and 1901 1100 feet, or 23·4 feet per annum, these figures being based on evidence afforded by a series of surveys and plans in the possession of Trinity House.

The Naze (Essex), which consists of low cliffs of gravel and sand overlying London Clay, is receding at the rate of 9 feet per annum. The North and South Forelands (Kent), which consist of chalk cliffs 20 to 150 feet in height, are receding at the rate of 2 feet per annum.

Mr. Mathews then proceeded to show how the estuaries of rivers were becoming changed, and referred to the interesting growth of Sunk island at the estuary of the Humber. He said that at the close of the seventeenth century this was an island of only a few acres, but that it had now an accumulation of warp or silt of over 15 square miles' area, and formed valuable pasture land. In 1660 it consisted of two huge sandbanks with a channel between them. In 1684 7 acres were enclosed. In 1744 1561 acres had been enclosed. In 1850 7000 acres had been enclosed. In 1906 9600 acres, or 15 square miles, had been enclosed. He stated that there were other large areas in the estuary of the Humber, covering nearly 100 square miles, which have also been reclaimed from time to time by warping.

The Tees estuary, he said, was formerly over 4 miles in width at its mouth, but more than 10 square miles of marsh land have now been reclaimed between Stockton and the sea. He also pointed out that the Wash, which forms the estuary of the Nene, Witham, Glen, Great Ouse, and Welland, previous to the Roman invasion extended many miles inland, covering large areas in the counties of Huntingdon, Lincoln, Cambridge, and Norfolk. The Romans reclaimed a vast area of land in this estuary, now known as Marshland and South Holland, by the construction of embankments over 50 miles in length.

The great level of "the Fens" was largely reclaimed in the seventeenth century, chiefly under the direction of the Dutch engineer, Vermuyden, and his work was extended from time to time to the last century. Mr. Mathews pointed out that this vast tract of most fertile land extends to over 1000 square miles.

On the north side of the Thames estuary the principal reclamations were Mersea island and lands bordering the river Blackwater, Wallasea isle, Foulness isle, Shoebury isle, Canvey island, Fobbing marsh, Tilbury marsh, and the long succession of lowlying lands bordering the river to a considerable distance west of London. On the south side similar reclamations have been made extending from London to Whitstable flats, including the Woolwich, Erith, Dartford, and Gravesend flats, Cliffe marsh, Stoke marsh, and parts of the isle of Sheppey.

He then briefly referred to the erosion and accretion that was taking place on the east coast generally, and pointed out that from the Tweed to the Tyne (Berwick to Tynemouth, 60 miles) the coast for the most part was rocky, consisting chiefly of limestone with shale and sandstone beds, and that little or no serious erosion had taken place during historic times. From the Tyne to the Tees (Tynemouth to Hartlepool, 28 miles) erosion had only taken place where the cliffs were of a soft nature, such as just to the north of South Shields, where the low cliffs are of glacial drift, and immediately to the south of Sunderland harbour, where the cliffs are formed of the same material, and in these places the erosion is at the rate of about 2 feet per annum. The remainder of the coast-line is rocky, and no erosion is taking place. He pointed out that north of Hartlepool large traces of blown sand occurred, which have driven the high-water line seawards.

From the Tees to Flamborough Head (59 miles) erosion is taking place, varying with the geological formation of the coast-line, and landslips are of frequent occurrence where glacial deposits occur, and in situations such as Runswick, where masses of clay overlay the slippery shale. The coast-line is intersected by deep

becks, many containing large deposits of glacial drift and boulder clay. At Filey the headland of hard calcareous grit known as Filey Brigg has resisted the erosive action of the sea, but to the south the glacial cliffs have been seriously eroded, forming a deep bay which extends as far as Specton.

Flamborough head to the Humber (45 miles) has already been referred to. Humber to "the Wash" (45 miles).

The Lincolnshire coast is lowlying, and consists of boulder clay and alluvial deposits. Sand-dunes fringe the coast, and here form an excellent protection, especially by planting and encouraging the growth of marram grass. Where erosion on this coast has occurred it has been very slight indeed; and, generally speaking, accretion is taking place, especially in the estuary of the Wash, as already referred to.

From "the Wash" to the Thames (Norfolk and Suffolk coasts) the coast-line, generally speaking, consists of glacial drift and boulder clay, with here and there sandhills or wide alluvial deposits and flat sandy banks. The sea-bed for many miles from the shore is very shallow. Great erosion is taking place on this coast.

The average rate of erosion at Sheringham during the past hundred years has been 2 feet per annum. At Southwold the loss has been estimated at from 5 to 15 yards per annum. Whole parishes and townships have been swept away on this coast within historic record. He said that Mr. J. B. Redman places the erosion of the coast-line between Cromer and Mundesley at an average of 14 feet per annum. At Cromer the sea is believed to have encroached 2 miles since Roman times.

Mr. Carey, M.I.C.E., says, "Considering how near to the coast-line are the broads and waters, like Lake Lothing, and also considering the great indentation of this outline, the apprehension which exists in the counties of Norfolk and Suffolk of serious inroads of the sea beyond the mere fronge of coast-line would appear to be justified." Between Lowestoft and Pakefield the loss of cliff is estimated by Mr. Wheeler, M.I.C.E., to be at the rate of 11 feet per annum.

From the Thames to Dungeness. At Herne bay the erosion is very great: between 1872 and 1896 it amounted to over 1000 feet; in 1903 an enormous landslip occurred. In fact, landslips are of frequent occurrence. Minster church, which a hundred years ago was 2 miles from the river, is now close to the latter. In Pegwell bay the chalk cliffs are being worn away. The average erosion of the chalk cliffs of Thanet is stated by Mr. Woodward to be about 3 feet per annum. The cliffs between Sheerness and Reculvers consist mainly of London Clay. South of Pegwell bay to Deal and Walmer is a low tract of marshland reclaimed from the sea. The chalk cliffs recommence at Kingsdown, 2 miles south of Deal, and extend to Folkestone. Between Folkestone and Hythe the cliffs consist of the Lower Greensand beds.

Mr. Mathews, in concluding his remarks, briefly referred to the satisfaction which had been given throughout the country generally by the appointment by the Government of a Royal Commission to investigate into the important question of coast erosion, which was a matter, in his opinion, not only of very great importance, but of national concern.

GEOGRAPHY AT THE BRITISH ASSOCIATION: YORK MEETING, 1906.

It is well known York was the first meeting-place of the British Association. It was chosen for geographical reasons, being conveniently central in days when transportation facilities were very different from what they are to-day. York is

still central, and there are many other reasons, historical and physical, which make it interesting to geographers to meet there. The Geographical Section, however, is not yet composed of a sufficiently large body of trained geographers to permit such use of the meeting-place for papers on special local problems and for interesting excursions as is made by the members of, say, the Geological Section. Indeed, geologists being generous and friendly folk, the geographer makes most use of the meeting by attending the Geographical Section in the morning and the geological excursions in the afternoon. The most enjoyable excursion was an "unofficial" one arranged by the geologists. It extended over two days, during which the features of the eastern half of the York moors were examined, under the guidance of Prof. P. F. Kendall, well known for his works on the glacial lakes of Cleveland and on the glaciation of Yorkshire, and for his excellence as the leader of such an expedition.

Coming to the work of the Geographical Section itself, it will be seen from the account given below that it was, as usual, both varied in its subject and its treatment. The section was constituted as follows:—*President:* Right Hon. Sir George Taubman Goldie, K.C.M.G., D.C.L., F.R.S. *Vice-Presidents:* Major C. F. Close, R.E., C.M.G.; Colonel D. A. Johnston, R.E., C.B.; J. Scott Keltie, LL.D.; H. R. Mill, LL.D., D.SC. *Secretaries:* E. Heawood (*Recorder*), A. J. Herbertson, E. A. Reeves, G. Yeld. *Committee:* Dr. Tempest Anderson, Major J. H. Beacom, J. Bolton, R. N. Rudmose Brown, Colonel Feilden, Major Forbes, J. Stanley Gardiner, Major E. H. Hills, C.M.G., D. G. Hogarth, Prof. G. W. Hoke, Prof. Emory Johnson, J. McFarlane, Dr. J. Milne, F.R.S., James Murray, J. L. Myres, H. Yule Oldham, J. Parkinson, Staff-Commander Dubois Phillips, J. Howard Reed, Clement Reid, F.R.S., Major P. Molesworth Sykes, John Thomson, and A. Trevor-Battye.

A large concert-hall was assigned to the section, which unfortunately had so bad an echo that it was very difficult to hear the speakers, and discussions were curtailed in consequence. With a crowded audience, the echo did not occur; but popular though the Geographical Section is, the whole hall was never filled during its meetings.

The President's address on the Progress of Geography during the quarter of a century which has elapsed since the last meeting of the Association at York has already appeared in the *Journal*. Several of the communications read to the section will also appear in the *Journal*. They will only be mentioned by title here.

The exploration papers were by (*a*) Major P. Molesworth Sykes, on a "Tour in South-East Persia," with an account of the ancient cities of Narmáshir; (*b*) Dr. Longstaff on his journey in the Central Himalayas and adjacent parts of Tibet. Major Sykes's tour was undertaken in connection with a commercial mission, which left Kerman in January, 1905. It is described in the paper printed in the present number of the *Journal*.

Dr. Longstaff's journey took place during the summer of 1905, the traveller being accompanied by an Italian Alpine guide and a porter. From Kumaon, the eastern glaciers of the Nanda Devi group were explored, and heights of over 20,000 feet attained. After a visit to the glaciers north of Nampa, in the north-west corner of Nepal, the party accompanied Mr. C. A. Sherring on his mission to Western Tibet. From Purang (Taklakot) Dr. Longstaff made his way to Gurla Mandhata (25,350 feet), reaching a height of about 23,000 feet. The whole party afterwards traversed the neck of land between lakes Mansarowar and Rakas Tal, and examined the channel connecting them. On August 28 Dr. Longstaff crossed the Chor Hoti pass into Garwhal, and in October made a reconnaissance up the Kuramtoli glacier. A detailed account of the mountaineering experiences has appeared in the August number of the *Alpine Journal*.

Mr. Stanley Gardiner gave an account of the Percy Sladen Expedition in H.M.S. *Sealark* to the Chagos archipelago, in amplification of part of the report of the British Association Committee for the Exploration of Parts of the Indian Ocean, of which Mr. Gardiner is secretary. The general results of the expedition have already appeared in the *Journal*.

Two lectures, admirably illustrated by lantern-slides, was the outcome of last year's visit of the Association to South Africa, and both attracted large audiences. Mr. Yule Oldham described the route and experiences of the official party, and Mr. Trevor-Battye gave an account of an expedition he made up the Zambezi above the Victoria falls into a still almost unknown region. Mr. John Thomson gave a lecture on "Photography for Explorers," illustrated by specimens of his own work, which will be illustrated in the *Scottish Geographical Magazine*. Another illustrated lecture had for its subject the Limestone Caves of Western Australia, the wonders of which were vividly described by Prof. W. B. Bottomley.

The section was fortunate enough to hear from Prof. W. M. Ramsay a summary of the results of his many expeditions to Asia Minor and long years' study of its past. After pointing out the importance of the geographical situation of Asia Minor as bridging the sea between Asia and Europe, the lecturer showed that the conquest by the Turks meant the reduction of great part of the country from the settled and civilized state to a semi-nomadic stage of society, the nomad Turks, or Turkmen, being the real conquerors of the country. In the cities the industries of the Roman Empire survived, but most of them gradually and slowly died out, largely owing to the difficulty of communication over the country. In earlier Turkish time trade passed with difficulty from city to city by aid of the large and splendid khans, which were, however, not a proof of civilization, but of the submergence of civilization, being fortresses in which caravans might rest safe from the nomads at night. The land also to a great extent passed out of cultivation. Only in recent times has a revival of prosperity taken place, the chief cause being the restoration of communication, partly through railways, partly through road-making, which in turn have led to a revival of industries and agricultural development. The lecture concluded with a discussion of the Bagdad railway and its prospects.

Two papers were of economic interest. The valuable, lucid, and interesting summary of the history and present position of irrigation in the United States, by Major Beacom, the American Military Attaché in London, will be communicated to the Society during the coming season, and will be printed in the *Journal*. Prof. Lyde contributed a note on the climate of Central Canada in its bearing on wheat-growing, showing the way in which advantage is taken for this object of the salient features of each season: the sudden and short spring, in which plough, harrow, and drill are hard at work; the rains of the three growing months, May, June, and July, with a rapidly rising temperature, the mean on the Brandon-Battleford curve being 62°·5 Fahr., or that of the best English wheat-land; the long summer days, with a high percentage of sunshine, but a comparatively long *cool* spell at night, particularly advantageous to wheat; the dry harvest weather; and the long cold winter, which guarantees the cleansing of ploughed land.

Prof. G. W. Hoke, of the Miami University, Ohio, urged the importance of a study of social geography, in a paper which it is hoped to print in the *Journal*.

Four papers dealt with physical aspects of geography. One by Mr. J. Parkinson, Principal of the Mineral Survey of Southern Nigeria, gave a valuable account of the configuration and structure of that part of the empire, which will be printed in full in the *Journal*.

Mr. James Murray contributed a summary of the work of the Scottish Lochs Survey from 1902 to 1906, of which very full accounts have appeared from time to

time in the *Journal*. He pointed out that, relatively to their size, the Scottish lakes are very deep. Most of the more important are U-shaped in cross-section, and the bottom is usually covered with a black peaty mud, though there are also yellow, green, and red clays. As regards the biology, the outstanding facts seem to be—(1) The great prominence in the lakes in summer of conspicuous species of crustacea belonging to the Arctic association of plankton species; (2) The exceeding richness of the phytoplankton, especially in desmids; (3) The abundance of certain orders of microscopic animals (Rotifera and Tardigrada) at the lake margins. The third fact probably indicates merely the habitual neglect of those orders in lake studies. Mr. Murray dwelt especially on the internal seiche which has been brought to light in some of the lakes. This was explained as resulting from the action of a gale, which causes the *Sprungschicht*, or plane of most abrupt fall of temperature, to take an oblique position. When the gale ceases, the fluids of different densities separated by this plane are free to oscillate, but, owing to the slight amount of difference, the period may be long and the amplitude great (three days and 150 feet in Loch Ness).

A most interesting discussion on the important question of coast erosion was introduced by Mr. Clement Reid, and continued by Prof. Kendall, Messrs. Whitaker, Mathews, and others. Mr. Reid's paper and an extension of Mr. Mathew's communication appear in the present number of the *Journal*.

The fourth paper was by Major Hills, on the Proposed Remeasurement of Geodetic Arcs in the United Kingdom. Members of Section A (Mathematics and Physics) attended this and took part in the discussion. Major Hills pointed out that the fundamental triangulation of Great Britain and Ireland was completed fifty years ago, and that, though excellent work for the time at which it was done, it is now far behind the standard of modern work of its class. The result is that the British work cannot be co-ordinated with the Continental series for the purpose of geodetic discussion, such as a determination of the figure of the Earth, and this though the necessary observations to connect the two series were actually made at considerable expense. To remedy this defect, it is merely necessary to connect geodetically, by as good a set of triangles as can be selected, the three extreme points of our island, viz. (1) Saxavord, the northernmost point of the Shetlands; (2) Valentia, on the west of Ireland; (3) the stations on the coast of Kent trigonometrically connected with France.

Were this done, amplitudes of 10° and 11½° respectively would be added to two very important lines of geodetic triangulation—namely, the meridional arc, though the longitude of Greenwich, and the longitudinal arc, along the parallel of 52° N. lat., which at present extend from the north-east corner of France to Ain Sefra in Algeria, and to Orsk in Russia, respectively—amplitudes of 18° and 57°. As a result of improved methods, and notably the invention of invar, the rate of progress of geodetic work has been greatly increased, while a much higher standard of accuracy can at the same time be realized.

Major Hills held that the work should be done by the Ordnance Survey Department, which was, he believed, quite ready to undertake it, and the total cost would be quite trifling compared with the existing national expenditure upon survey work.

The report of the committee on the survey of the Indian ocean has already been alluded to; that by the Rainfall, Lake and River Discharge Committee was an interim one. The committee of the section asked for the reappointment of the latter committee with the unexpended grant. They also recommended the reappointment of a committee on changes of sea-level in the Mediterranean, with Mr. Günther as secretary, and this was ultimately obtained with a grant of £50. The sectional

committee also supported the application of Section I (Physiology) for the reappointment of a committee on the relations between Climate and Health, and one by Section H (Anthropology) for a committee on the further archæological exploration of South Africa, this last being, however, eventually withdrawn, owing to the insufficiency of the funds available for scientific investigations.

In the work of other sections, the following papers presented points of geographical interest: Mr. H. Brodrick, "On Faults as a Predisposing Cause for the Existence of Pot Holes on Ingleborough;" Mr. R. D. Oldham, "A Criterion of the Glacial Erosion of Lake-basins;" Mr. F. W. Harmer, "The Glacial Deposits of the East of England;" The Rev. W. Lower Carter, "Notes on the Glaciation of the Usk and Wye Valleys;" Dr. H. Johnston Lavis, "Recent Observations at Vesuvius." Dr. Tempest Anderson's evening discourse on "Volcanoes" should also be mentioned.

One of the pleasantest features of the meeting was the informal afternoon gathering in the gardens of the Philosophical Society, at the invitation of Dr. Tempest Anderson, the president.

REVIEWS.

EUROPE.

The Balkan Lands.

'Remarks on the Ethnology of the Macedonian Slavs. By Dr. J. Cvijić. Translated by A. O'Brien (privately printed). 1906.

'Macedonia: its Races and their Future.' By H. N. Brailsford. Illustrated. xx. + 340. Methuen & Co. 1906.

'A Military Geography of the Balkan Peninsula.' By L. W. Lyde and Lieut.-Colonel A. F. Mockler-Ferryman. vi. + 203. A. & C. Black. 1905.

'Pictures from the Balkans.' By J. F. Frazer. Illustrated. xii. + 298. Cassell & Co. 1906.

'By-paths in the Balkans.' By F. W. von Herbert. Illustrated. ix. + 269. Chapman & Hall. 1906.

The mere traveller cannot hope to advance knowledge of the geography of the Balkan lands in any other respect than the actual distribution of political groups, and to do even so much he must possess rather unusual qualifications; for, in a country like Macedonia, things are rarely what they seem on the surface. An acquaintance with vernaculars, sufficient to render a traveller independent of his dragoman, and a considerable knowledge both of Near Eastern ethnology and the workings of the Near Eastern mind, are absolutely necessary, if his impressions are to have any serious value. The books before us bear abundant unconscious witness to the truth of these premisses. The author who is the best qualified to know is conspicuously the least prepared to dogmatize; and to all travellers in Macedonia, who, like Mr. Foster Frazer and Mr. von Herbert, find little difficulty in deciding on ethnical matters, we would recommend, in all confidence, a study of Dr. Cvijić's pamphlet. The learned Servian professor knows, at any rate, how little is known, and has no hesitation in stating the fact. In doing so he does very valuable service, for, though almost entirely destructive, he clears the ground of a jungle of half-truths and entire misconceptions which pass current for the facts of the political geography of Macedonia. The main results of his deliberate and temperate study on the spot issue in two conclusions: (1) that, ethnically, the Macedonian Slavs are Macedonians, and not either Servian or Bulgarian Slavs; (2) that they have no strong or ancient sense of identity with any other Slav nationalities, but are a

floating unit, easily influenced by whichever of those nationalities offers at a given moment the most obvious hope for the future. Incidentally he demonstrates the exceedingly unsound character of the maps and statistics on which almost all other writers have based their conclusions. He is studiously impartial; but, considering his treatise impartially in our turn, we cannot fail to remark that his destructive criticism makes very considerably for Servian interests. To begin with, he excludes the Kossovo vilayet from Macedonia, claiming that without question for Servia. For the rest, the false growth which he clears away is almost entirely Bulgarian, and if the Serb gains nothing the Bulgar has much to lose. The latter's propaganda has had a long start and gone far, while that emanating from Belgrade is comparatively recent, and has penetrated but little south of Uskub. Bulgarian patriots will inevitably say that, by negativing their ethnical and historical pretensions equally with the Servian in the Monastir and Salonica provinces, Dr. Cvijić deals a blow at Greater Bulgaria ten times more heavy than that which he aims at Greater Servia.

Nevertheless, though we cannot help hoping that another ethnologist, as well equipped as Dr. Cvijić, but wholly above suspicion of having any "axe to grind," will verify his results in Macedonia, we do not withhold assent from his main contention. The experience of every well-qualified observer, who has seen the people with his own eyes, goes to prove that the national sense of nine-tenths of the Macedonian Christian population is still quite fluid, and that the stress laid by rival claimants on linguistic and historical considerations has created a mass of false opinion in Europe, which is not shared in the country itself. Except in certain frontier districts, like Razlog on the one side, or the lower Vistritza valley on the other, the population is essentially Macedonian, and only accidentally or temporarily Bulgar or Greek; and beyond that fact let us admit at once that we know uncommonly little about it. Originally, it was, probably, to a large extent, one with the Slavonic mass upon which the North Asiatic Bulgar imposed himself in the lands immediately south of the Danube; and it differs now from the Bulgarian just in that one all-important respect—that it remains pure Slav, and not Bulgar-Slav.

With Dr. Cvijić's treatise before one, it is impossible to attach much importance to such records of less instructed travellers as are set forth in either the 'Pictures' of Mr. Frazer, or the 'By-paths' of Mr. von Herbert; but we would distinguish between these books, to the advantage of the former. Mr. Frazer's volume is quite a good bit of "special correspondent" work. He knows nothing of the vernaculars, and he galloped over well-trodden paths; but he shows himself acute, sensible, and laudably fair according to his lights. Mr. von Herbert, on the other hand, evidently knows something of the Turkish and a little of the Bulgarian tongue, and he implies, rather than states, that he penetrated many dark corners. But a writer who infuses so much meretricious romance into his narrative, has only himself to blame if he convinces least when he wishes to do so most. He may know "things not generally known" about the gipsies of the Balkans and about many other picturesque individuals, but few who read his book would accept his evidence without a deal of corroboration.

Mr. Brailsford is in a different category. He has not Dr. Cvijić's qualifications for discussing the ethnology of the Macedonians, but, on the other hand, he has enjoyed unusually good opportunities for studying the actual political grouping in the most disputed districts. His acquaintance with Greek populations is not of yesterday, and he went to the Slavs of Macedonia under circumstances which enlisted their sympathies in an especial degree. He has studied the latter with an open and well-instructed mind, and, so far as he was able, has penetrated below the surface. As an account of the modifications introduced into the political

grouping by the Bulgarian activities of the past five years, his book is by far the best we have, and as a fair record of the state of things up to the present date, it will retain permanent value. He concerns himself in the main with actualities, and has as little belief as Dr. Cvijić in the practical value of the historic claims put forward by the rival claimants. If those interested in the Balkan question will read Dr. Cvijić first, and then Mr. Brailsford, discounting the latter's certainty by recollection of the former's scientific doubts, they will arrive at as fair a view as is attainable in these latter days.

The work of Mr. Lyde and Colonel Mockler-Ferryman stands quite apart from the rest. It is an attempt to state the effect which the permanent geographical conditions of the Balkan lands, and the recent modifications introduced into them by military engineers, would have on strategic operations in the future. A short account of the Balkan campaigns of the eighteenth and nineteenth centuries is added by way of proof and illustration. The book is very interesting, and one feels throughout that one's idea of the geographical conditions gains much precision by reading a consideration of them from a single point of view. At the same time the book often lacks the touch of one acquainted at first hand with all the country described, and, we fancy, would be annotated considerably by, say, the Austrian general staff. The dogmatic laws of the military school are subject to a good deal of modification—*ambulando!*

D. G. H.

AMERICA.

The Selkirk Range.

'The Selkirk Range.' By A. O. Wheeler, F.R.G.S. Ottawa: Government Printing Bureau. 1905.

The Dominion Government have issued the first volume of what is, practically, a monograph on "the Selkirk range" in British Columbia. The author, Mr. Arthur O. Wheeler (Topographer to the Department of the Interior), describes the work of his first year's survey thus: "A continuous zone has been topographically surveyed for some miles on either side of the railway (connecting with a previous survey of the Columbia valley), forming a base from which the work can be expanded in any required direction. During the second year the survey was extended southward to embrace all previous travel and explorations of the higher Selkirk summits, and to enable a reliable guide-map to be furnished to tourists and mountaineers."

The Dominion Government were fortunate in their selection of Mr. Wheeler for such a work, and he has produced a most readable book, profusely illustrated. Photographs of mountains and glaciers predominate, but those of the characteristic plants amid their natural environment, by Mrs. Charles Schäffer, cannot fail to interest other readers than those who can call themselves botanists, and the appendices on geology, zoology, botany, and meteorology make the work complete.

Now that the Selkirks have been pierced by a railway, trails opened, and forests burned, it is hard to realize the barrier which this range formed in its primeval grandeur. The rivers through the prairie regions and the streams of British Columbia were the routes followed by the fur traders of the early days. In many cases these pioneers from the east pushed their way into the Rockies, and in course of time crossed the Divide and made their way down into British Columbia. The Athabasca pass, however, which avoided the Selkirk region, was the favourite route.

In 1857 an entirely new system of exploration was inaugurated, when an Imperial Commission was appointed to explore for a railway route to connect ocean with ocean. When boys of the generation now passing away were reading Fenimore Cooper's novels, and living in imagination with buffaloes, grizzly bears, and Red

Indians, Captain Palliser, Sir James Hector, and their party were exploring for a pass to the Columbia, and when the Kicking Horse pass was discovered, the exploration of the Selkirk range flanking that pass to the west had to be tackled. In 1872, "Mr. Walter Moberly and his assistants were the first, of whom there is a record, to penetrate the northern portion of the Selkirk mountains. . . . It was not till sixteen years later (1881) that Major Rogers traced the Illicellewaet river to its source, . . . and gazed upon the little marshy meadows nestling snugly among patches of spruce trees at the summit of the pass through which the railway was destined to run."

In the appendix is a most interesting account of Major Roger's journey, by his nephew. Travellers nowadays will be surprised at the "iron-clad contract" that was necessary to compel his Indian packers to go through with the job. Passing from these early explorations, Mr. Wheeler devotes Part iii. of his book to "Previous Surveys." The railway was pushed through before any map of the range was attempted, and I must take this opportunity of thanking Mr. Wheeler for his appreciative remarks on the rough survey which, with the assistance of the Royal Geographical Society, I carried out in 1888.

The Selkirks have now lost much of their mystery, and fire has deprived them of some of their beauty, but they are now accessible, and guides brought from the Bernese Oberland are to be found at Glacier every year, to pilot visitors over the glaciers and to the summits of peaks, from which views of surpassing beauty in the clear air of the Selkirks may be enjoyed. Beyond the zone now surveyed there are still untrodden glaciers and unclimbed peaks, and in approaching them mountaineers of the future will meet with all the difficulties presented by the primeval forests which rendered the Selkirks so perplexing to the early pioneers.

Mr. Wheeler, in dealing with "Mountaineering in the Selkirks," says, "Many fine peaks have not been approached at all. Noticeably, an isolated rock tower with several outlying spurs and dependent glaciers immediately to the west of Mount Bonney. It has been named Mount Smart." "North of Hermit range at least three isolated peaks rise supreme above their fellows, one of them, that to the north-east, undoubtedly the highest in the Selkirk range. There is much that may yet be done before these peaks are known, named, and mapped." Mr. Wheeler has here touched a note which will, no doubt, find a response in the near future.

W. S. G.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Survey Methods.

'Hydrographic Surveying: Methods, Tables, and Forms of Notes.' By S. H. Lea. New York: The Engineering News Publishing Co. 1905. *Price* 8*s. net.*

This book is intended for the instruction of surveyors of water in any shape or form. It is obvious that sounding work is more expeditious and accurate if carried out from a steam or motor boat than from a row-boat. The author might specially note this point in a future edition. In one or two matters, such as sounding with ordinary lines, the author's method seems rather antiquated, but his directions for carrying out the operation are clear and good. There are some interesting chapters on fixing the flow of water in a river, and many ingenious instruments and the methods of using them are described.

Weirs and their construction are discussed, a matter about which there is still much to learn. The book deals only with methods in use in the United States, but will prove a useful and instructive manual to those who are engaged in similar work over here.

D. W. B.

Tides and Waves.

'A Practical Manual of Tides and Waves.' By W. H. Wheeler, C.E. London: Longmans. 1906.

This useful manual gives an interesting account of the tides and of wave-formation, setting forth the different theories and methods of their investigation and the practical results obtained. The author shows that there are many mathematical problems involved in the elucidation of the correct history of the tidal system. The chapters on the effects of wind and atmospheric pressure are clear and good. Many examples are given. The chapter on tides in rivers is also interesting. There is a good account on the effect of the wind on the waves at sea, and also of the occurrence of what the author calls seaquakes, and of the great single waves sometimes encountered with disastrous results. It is curious that the author goes back to the beginning of the last century for some of his data on these points, but entirely overlooks the fact that there have been quite recent investigations on the effect of wind force on waves at sea.

The book is a useful one, and can be confidently recommended to all who are interested in the problems treated of.

THE MONTHLY RECORD.

EUROPE.

The Frische Haff, on the German coast of the Baltic, is the subject of a paper by Dr. G. Braun, of Königsberg, who has previously been known to geographers for his investigations of some of the North German lakes (*Zeitschrift f. Gewässerkunde*, VII. Band, 3 Heft). Dr. Braun has worked up the data scattered in previously existing literature with the results of his own observations, so as to present a concise view of the general physical conditions of the lagoon. The morphological features are marked by considerable diversity, as the Haff touches not only the East Prussian zone of depression, but the more elevated ground formed by the diluvium of the ice-age. The coasts show three distinct forms: that of the low-lying alluvium, the so-called "Hakenküste" formed by dunes, and the cliffs of the diluvium. The alluvium is extending its area and introducing modifications of form, while the higher portions are being more slowly worn away. The Haff (which word is the equivalent of the Danish *Hav*, "sea," while the distinctive epithet refers to the comparative freshness of its water) was formed, on the site of a depression dating from the ice-age, by the heaping up of the material brought down by the Vistula, under the action of the current which runs along this coast. Dr. Braun deals fully with the *régime* of the water and its movements. The lagoon is remarkably shallow, the maximum depth being only 16½ feet. The water-supply is derived mainly from the Nogat branch of the Vistula and (to a less extent) from the Pregel. An admixture of fresh and salt water takes place through the "Tief," or outlet, near Pillau, the currents in which vary under the influence of winds. For a considerable proportion of the year there is an influx, even at the surface, and observations of temperature and salinity show that when there is an outflow of fresh water at the surface, there is frequently an undercurrent of salt water setting inwards. Cases are known in which the flow from surface to bottom has been reversed in a single day, though the process is usually slower. The conditions are similar outside the outlet, where the lagoon water can be sharply distinguished from the sea water by

its colour. The salt undercurrent can often be traced almost to the inner extremity of the lagoon, but is confined to the central channel. The Königsberg ship-canal is generally filled with brackish water, though the rest of the lagoon may be entirely fresh. Great variations of level occur under the action of the wind. Dr. Braun concludes with some notes on the economic relations of the Haff, which by means of the ship-canal participates in over-sea commerce, while standing at the head of the German coast waters for interior traffic. In the days of smaller craft the position was more favourable than at present to the towns round its shores, most of which have of late years seen their prosperity diminish. Königsberg, however, forms an exception, since the opening of the ship-canal, which has favoured it at the expense of Pillau.

Geography in Hungary.—From the annual report of the President of the Hungarian Geographical Society, Prof. L. von Lóczy, the following statements indicative of the present state of geographical research as pursued in Hungary may be cited. In his treatise, 'Regularization of Rivers and Improvement of Soil in China' (in the Hungarian language), Dr. Jenö Cholnoky, well known for his travels in Eastern Asia, has given an excellent picture of the hydrography of the great Chinese plain. At the instigation of the Oriental Congress at Rome there has been formed an International Union for the Anthropogeographical Study of Asia, and to this union a Hungarian commission has also been affiliated. Dr. George Almásy and the geologist, Dr. Gyula Prinz, will shortly enter on a journey of research in the interior of Asia. The Russian explorations in the Caspian sea confirm an old opinion of Lóczy's, according to which animal bodies, rotting at the bottom of retired seas in foul, stagnant water, and covered with a layer of mud, yield petroleum. The ancient petroleum-beds, in the early Tertiary strata of the Caucasus, as also of the Carpathians, may in their time have arisen in land-locked sea-basins in the same way as the deposits of animal bodies on the present floor of the Black and the Caspian seas. Towards the investigation of their own land contributions have again been made, more particularly by the Royal Geological Institute and the Hungarian Geological Society connected with it. For the study of the South Carpathians and the Transylvanian Alps the work of Baron Fr. Nopesa, jun., on the 'Geology of the District between Gyulafehérvár, Deva, Russkabánya, and the frontier of Roumania' (in Hungarian), will hardly be dispensed with by the geographer. The treatise, too, of Vilmos Güll, Aurél Liffa, and Imre Timko, on the Ecseder moor and its agricultural conditions, has a geographical bearing. Both works appear in the Year Book of the Royal Hungarian Geological Institute (14th vol.). Among the agro-geological reports noteworthy observations on the physiogeographical conditions of the Alföld are to be found. In the region of the Krapina commune (Styrian frontier) Prof. Goryanovics-Kramberger of Agram discovered remains of diluvial man, together with remains of the *Rhinoceros Merkii*, and placed the results of his investigations before the Hungarian Geological Society. The same geologist is also publishing, with explanatory text, the geological map of Croatia, on the topographical basis of the Austro-Hungarian special map-sheets on the scale of 1:75,000. In the journal of the above-mentioned society has also appeared (in German) a treatise by Dr. Fritz Frech, professor in Breslau University, on the animal world of the marine deposits of the Carboniferous period in Hungary, a paper of no small importance for the palæogeography of Hungary. For over twenty years the hydrographical department of the Ministry of Agriculture has been occupied with the study of the waters of the land. In its service the hydrologist, Odön Bogdánfy, has published (in Hungarian) his 'Hydraulics of Natural Running Waters.' In these two volumes the data bearing on the hydrography and hydrology of the Hungarian rivers have a geographical import. By the publication

(in Hungarian) of Viczian's work on the water-power of Hungary, the Ministry has rendered a service, not alone to technology, but also to national economy and to geography. Of geomorphological importance is the prize-essay of Vilmos Sóbányi, on the 'Hydrography of the Tributary Rivers on the Left Bank of the Danube, with special reference to the Formation of Terraces,' published by the Academy of Sciences. Of the geographical literature of a popular character, published in Hungary, mention can only be made here of the magnificent work of Franz Gáspár in several volumes, richly illustrated, entitled 'The Book of Culture' (in Hungarian). Of this work one volume, wholly devoted to geography, is now being printed. A large Hungarian general atlas is also in immediate prospect of publication. The interruption which has occurred in the publication of the 'Results of the Scientific Exploration of the Balaton Lake' (in Hungarian and German), is connected with the political situation. Among the publications under this head, the great work of the lamented Janos Jankó, on the 'Ethnography of the Dwellers surrounding the Balaton Lake,' is being re-written and translated into German. Lastly, the Berlin International Seismological Conference of August, 1905, has founded the "International Union for the Observation of Earthquakes," and has elected as its secretary Dr. Radó von Kövesligethy, Professor of Geophysics and Geodesy at Budapest. Under this stimulus a seismological station of the first rank has now been erected in Budapest, the management of which has been committed to Kövesligethy.

ASIA.

Mr. and Mrs. Workman in the Nun Kun Mountains.—A correspondent writes: "Mrs. Fanny Bullock Workman and Dr. William Hunter Workman have successfully completed their exploration of the Nun Kun mountain group in Suru, Kashmir, the expedition having occupied ten weeks.* They were accompanied by the Italian guide, Cyprien Savoye, who was with them in Baltistan in 1903, and six porters. The entire circuit of the Nun Kun group was made for the first time, this involving a rough journey of between 90 and 100 miles from Suru, just north of the mountains, out and return. The distance was considerably increased owing to the necessity of making three extra marches up the Randun valley to find a fording-place over the glacier-fed Suru river, greatly swollen from the unusual melting of the ice, due to the prolonged fine weather and great heat. In making this circuit, three glaciers were ascended and two descended, three snow-cols of over 17,000 feet and one 500 feet lower crossed, and one steep pathless rock mountain traversed, probably never before trodden by human foot. The central portion of the Nun Kun massif rises sharply high above the steep jagged peaks that guard the approaches to it on all sides. At an altitude of over 20,000 feet it culminates in an oblong glacial basin, 3 miles long by 2 wide, enclosed by five rock and snow summits, three of which tower to heights of over 23,000 feet, the highest having been fixed at 23,447 feet. To explore this portion, a base camp was established above the north lateral moraine of the Shaffat glacier, at an altitude of 15,100 feet, from which two snow camps were made on the wild, broken, glacial slopes above, at altitudes of 17,657 and 19,893 feet, and two more in the high glacial basin at altitudes of 20,632 and 21,300 feet. On the two nights passed at this camp, the temperature fell to $-4°$ and $-6°$ Fahr. The highest peak having been found to be inaccessible from the basin, an ascent was made of the next highest, 23,264 feet, its steep, broken, ice-covered slopes demanding hours of step-cutting and the exercise of the greatest caution. At a height of 22,656 feet, as clouds were beginning to obscure some important

* A first exploration of this group, by Dr. A. Neve and the Rev. C. E. Barton, was described in the *Alpine Journal* for February, 1903 (see *Journal*, vol. **21**, p. 671).

landscape features, Dr. Workman and one porter stopped to make observations and take photographs before the view should be cut off; while Mrs. Bullock Workman, with guide and one porter, went on to complete the ascent, which gives her a place in the small category of those who have passed 23,000 feet. The continued daily exertion in rarefied air, the loss of sleep owing to disturbance of respiration by the altitude, and the effect of the great cold upon the vital powers thus weakened, proved trying to all, and, after five sleepless nights at 19,900 feet and above, all felt the need of returning to lower altitudes. Later, from the Barmal La, 17,228 feet, ascents were made of two sharp snow-peaks, one on each side of the head of the Barmal glacier, whose final slopes rose at from 70° to 73°. The first had an altitude of 18,750 feet, and the second, D 41 of the Survey, that of 20,168 feet. On the summit of the latter, the party was enveloped in a dense fog, accompanied by an icy wind, which lasted for several hours. In this the descent was accomplished by following the trace which had been made in ascending. The topographical features of the region were found to differ materially from those shown on any existing map.

Mr. W. Rickmers in Central Asia.—Mr. Rickmers writes from Garm, in Bokhara, under date September 1, 1906, stating that he has traversed the Zarafshan valley throughout the whole length, ascending to the very head of the glacier beyond the point reached by Mushketoff in 1880. He found the Macha pass to be only a lateral saddle. The glacier has receded considerably of late, having lost about 100 feet of its length since last year. Mr. Rickmers has made some interesting observations on the glacial and other phenomena of the district, and has visited the Fantagh group, mapping its southern portion, and studying the lakes, moraines, landslips, and glaciers of the Pasrut valley. Writing again on September 22, he reports having completed a thorough investigation of the central portion of the Peter I. range.

Great Britain and Tibet.—The text of the Convention between this country and China, signed at Peking on April 27 last, confirming the treaty negotiated by Sir F. Younghusband in 1904, has been printed as a parliamentary paper ('Treaty Series,' No. 9, 1906). By Art. 2 Great Britain engages not to annex Tibetan territory, nor interfere in the administration of Tibet, while China undertakes not to permit any other foreign nation to do the like. In regard to the section of Art. 9 of the original treaty, which stipulated that no concessions for railways, roads, telegraphs, mining, and other rights shall be granted to any foreign power, it is now stated that such concessions are denied to any state, or the subjects of any state, other than China; permission being, however, given for the telegraphic connection with India of the trade-marts to be opened in accordance with the former treaty. The text of that treaty is printed as an annex.

Dr. Tafel's Journey to Tibet.—A letter from this explorer is printed in the ninth number of *Petermanns Mitteilungen*, which shows that, nothing daunted by the disaster which befel him on his first attempt to enter Tibet from Kuku-nor, he has made a renewed advance in this direction, though it does not appear how far he had penetrated at the time of writing, his letter (written on April 17 last) being merely headed "Tibet, Lagerplatz IV., ca. 1700 m. hoch." He is travelling as a Kashgarian merchant, his caravan-bashi posing as a second, while his ten men, most of them experienced in travel in Tibet and neighbouring regions, and apparently trustworthy, are all armed with Remington rifles. He had been waiting for some days in a snowstorm in order to complete his supply of baggage animals, which he hoped to make up to one hundred, seventy of them yaks. He complained of the treatment he had met with from the local authorities in the Kuku-nor district, having received nothing in the way of indemnity for the plunder of his caravan, although the Amban had exacted a fine of about £150 from the chief in whose

district the attack had taken place. In his opinion, a new Boxer revolution was in full course of being hatched in that part of the empire.

AFRICA.

The Rainfall of Africa.—An attempt to bring together in generalized form the now rapidly accumulating data on the rainfall of Africa has been made by Dr. G. Fraunberger, who has published the resulting rainfall map compiled by him in *Petermanns Mitteilungen* (1906, No. 4). This map deals only with mean annual rainfall, and the important question of seasonal distribution is not touched, but so far as it goes, the author's work is a valuable step in advance, being based on a careful study of almost all the available data, while, although necessarily still showing only the broader features of rainfall distribution, it enters into considerably more detail than previous attempts in the same direction. With one or two exceptions,* Dr. Fraunberger seems acquainted with all the important contributions to the subject that have yet appeared, but though he has embodied a good deal of the previous results, he has throughout made an independent study of the data (which consists of observations from over four hundred stations), and has not hesitated to make corrections where necessary. He has, perhaps, in one or two instances shown too great a confidence in previous work, much of which has necessarily been given in an exceedingly generalized form, and though positive errors have, as already remarked, been eliminated, the map might possibly have been still more valuable had it been based solely on an independent study of the records, though this might have involved more labour. In the accompanying letterpress Dr. Fraunberger mentions the principal points on which his conclusions differ from those of his predecessors, and also sketches the influence of geographical and other factors in determining the distribution. The actual observations being still far from adequate to afford a complete basis for such a map, it is, of course, necessary to rely to a certain extent on *à priori* deductions or indirect evidence. Thus the author depends more than once on the facts of vegetation distribution, though these are, perhaps, not quite sufficiently established to be a trustworthy guide. One point of difference from former maps is the smaller annual rainfall assigned to the Air and Tibesti highlands near the southern border of the Sahara, which Dr. Fraunberger, on the basis of Foureau's observations in the former, places at under 200 mm. (8 inches). This is the lowest step in his scale, which ascends in the main map by eleven gradations to an amount of over 4000 mm. (160 inches). The heavy precipitation near the head of the Gulf of Guinea is shown on an inset by a different scale, which distinguishes a maximum, along the small strip of coast west of the Kamerun mountain, of over 10,000 mm. (393 inches). The author points out the influence the rift-valleys (especially in the case of Nyasa and Tanganyika) have on the distribution of rainfall, the eastern sides being markedly drier than the western. He is unable to account for the comparatively small amount of precipitation on the Gold Coast, which still awaits a satisfactory explanation. Some corrections will, no doubt, be necessitated when the data become more complete. Thus it seems possible, at least, that the rainfall assigned to the Ruwenzori range is too small, being shown as considerably less than that of various other mountainous areas of East Africa. A table gives the observed annual precipitation at about four hundred stations, with a statement of the number of years (still far too few in the majority of cases) during which observations have been made.

Mr. Vischer's Expedition.—A Reuter telegram from Tripoli, dated October 19,

* No account seems to have been taken of Mr. Sutton's work with respect to South African rainfall, or Sir Harry Johnston's rainfall map of Uganda, printed by the Intelligence Division in 1900.

reports that Mr. Vischer (*ante*, p. 181) was attacked by Tuareg near Tejirri (a place on the route south from Murzuk, about 120 miles from that town), but repulsed his assailants with the help of the villagers. The date of the occurrence is not stated.

Colonel Laperrine in the Sahara.—A new expedition into the heart of the western Sahara has, as is stated in *Globus* (**90**, No. 12), been carried out this last summer by the indefatigable Colonel Lapperrine, who reached Taodeni, the site of the well-known salt deposits. The march, in the heat of summer, was an exceedingly trying one. On the outward route no pasturage was found for a distance of 125 miles, and the animals suffered much, while the badness of the water-supply caused great difficulties on the homeward march. Colonel Laperrine does not share Prof. Gautier's opinion that Taodeni is the site of a former inland sea on which the drainage of a large part of the Sahara converged, as the salt deposits cover but a small area. If such a basin exists, he thinks it must be sought elsewhere.

Dr. Frobenius in the Congo Basin.—This traveller has now returned to Germany after completing his researches in the southern Congo basin (*Zeitschrift Ges. Erdkunde, Berlin*, 1906, No. 7; cf. *Journal*, **26**, 672; **27**, 629; **28**, 181). The last section of the journey was devoted to the basin of the Sankurru, the northern tributary of the Kasai first explored by Dr. L. Wolf, but which has generally remained more or less off the routes of travellers. Although Wolf's map was an excellent piece of work, he gave no detailed account of the river, and Dr. Frobenius is able to add to our understanding of the general characteristics of the country through which it flows. During its passage across the plateau land proper, a striking feature is the regular alternation of low and high banks, due to its having cut through the surface undulations of the sandstone formation. About the point where it first takes a westerly course the banks form walls of stone, 150 to 200 feet high, relieved by tall forest. To the south of this, steppe, and to the north, forest prevail. The river passes at Batempa through a rock-gate and enters the flatter land. The traveller was struck by the rapid increase in size of the streams within short distances, especially in the case of the Lubi, which must receive most of its supplies by percolation from the plateau swamps through limestone strata. The lower part of the Sankurru is very unpleasant to navigate, being very shallow, and obstructed in the dry season by many more sandbanks than the Kasai. Though there is an extensive forest in its upper basin, its westward-flowing section is merely bordered by a narrow strip of forest. Dr. Frobenius thinks that the forest through which Kund and Tappenbeck passed in their journey to the north of the Kasai cannot extend far from the banks of the Lukenye. A strange tradition among the natives has it that in ancient times the Sankurru flowed north, and the accounts of the arrival of people from this direction in boats recalls some of the stories told to Stanley on his descent of the Congo. The rainfall in this region has been extraordinarily heavy this year, and stories are told of whole villages being inundated and the inhabitants forced to build platforms on piles and move about in boats. With regard to the native tribes, the traveller says that about Lusambo there is a meeting of races such is hardly to be seen elsewhere in Africa. His study of the Bassongo Mino, the truculent tribe of the lower Sankurru, led to the unexpected conclusion that they form part of a series of tribes, occupying a very large area within the bend of the Congo, who all speak practically the same dialect, use the same bows, shields, and other articles, and live in similar houses. Light is thrown on the past movements of races by the present distribution of ethnological characters, among others the use of the throwing-knife.

The Frontiers of Nigeria.—As has been mentioned in the *Journal*, joint commissions, representing Great Britain and France and Great Britain and Germany

respectively, met in London in the early part of the year for the purpose of making proposals for the drawing of the boundary-lines of Nigeria, to the north and south respectively, on the basis of the surveys of the commission which had previously examined the country on the spot. The recommendations of the Anglo-French commissioners were adopted in a convention signed in London on May 29 and since ratified, which has been printed as Treaty Series, No. 14, 1906. The frontier decided on follows a very irregular course defined by certain fixed points which are specified in the text of the Convention, and shown on a large-scale map in two sheets annexed to it. It is impossible to define it in few words, but it may be said that the result is to adhere to the general line of the frontier as fixed in 1904, though one or two modifications of more importance are made in favour of France. Thus, south of Zinder the line runs considerably south of its position according to the agreement of 1904, while, after striking Lake Chad at the mouth of the Komadugu, it slopes to the south-east before reaching the meridian 35′ E. of Kuka, which has hitherto formed the extreme eastern limit of Northern Nigeria, as indeed it continues to be south of 13° N. This is to secure to France the whole eastern shore of the lake, which, owing to the growing restriction of the water area on this side, would not otherwise be the case. Among other provisions of the convention is one guaranteeing free navigation on the lake both to British and French subjects or protected persons. The southern frontier of Nigeria, from the neighbourhood of Yola to Lake Chad, was defined in accordance with the recommendation of the commissioners by an exchange of notes between the British and German governments on July 16, and is shown on a map given in the *Deutsches Kolonialblatt* for September 15. The same system has been followed as in the case of the northern boundary, straight lines as a rule being avoided, but the line defined by a number of points or natural features in the topography of the country. For more than half its course the line follows the Yadseram stream, which loses itself in the swamps south of Chad in the neighbourhood of Dikoa, and, curiously enough, diverges to no great distance on either side of a straight line from the Benue near Yola to Lake Chad. The last part of the boundary cuts the meridian 35′ E. of Kuka, at a point just above high-water mark of the lake, which was marked on the spot by two pillars during the course of the boundary surveys.

The Place of Hornemann's Death.—The circumstances of Hornemann's death were such as to render it little likely that all the uncertainties connected with it will ever be cleared up. According to the report sent to Captain Lyon in Murzuk in 1819, the traveller made his way to Noofy (Nupe), at the chief town of which, "Bakkanee," he died. Dr. Pahde, in his memoir of the traveller published in 1895, thought that he must have reached the Niger between Say and Gomba, and was inclined to identify the place mentioned with Bikini, one of the localities touched at by the German Togo expedition of 1895. This involved the supposition that the influence of Nupe extended, in Hornemann's time, further north than in more recent years. The writer of a note in *Globus* points out, however, that a place named Bokane exists in Central Nupe, a little north of Rabba, and that this was probably the place in question. This view is supported by the statement of Clarke ('Specimens of Dialects,' p. 81: Berwick, 1848), in reference to a people in the Nupe country near Rabba, that "it was in this part of Africa that Hornemann died." Bokane may once have been the chief centre of Nupe, as Flegel mentions an extensive wall surrounding it, and enclosing cotton plantations and scattered groups of houses.

The Gold Coast Interior.—A Colonial Report (No. 493) for 1905, on the Northern Territories of the Gold Coast, records the opening of a new administrative post at Navarro, commanding the district between the Sissili, the Red Volta, and

part of the White Volta. Twenty-four thousand square miles in area, the Territories have a population estimated at 2,500,000. The rainfall for 1905, 55·71 inches, greatly exceeded that of any of the last three years. A large market has already sprung up, and many Hausa traders have settled at Navarro. A complete reorganization of the administrative centres will, it is hoped, serve to draw more closely the bonds between the more populated regions and the British Administration. The demand for clothing which has suddenly sprung up is being supplied at present by the Germans in Togoland. The Lobi-Dagarti and Dagomba countries, too, have to obtain a great deal of cotton for cloth-making from Moshi traders, who get it from French territories. There is a promising field for the growth of sugar and rice. The country is eminently suitable for cattle-raising. A large force of young men is available for labour in the Tarkwa and Ashanti mines, their utilization for this purpose being approved by the chiefs. The year under review is further notable for the issue of the first reliable maps of the northern territories.

AMERICA.

Ascent of Mount McKinley.—According to a Reuter telegram from New York, dated October 3, Dr. F. A. Cook, whose new expedition to Mount McKinley was referred to in the August number of the *Journal* (p. 183), has succeeded in reaching the summit of the mountain, which is the highest known peak in North America. It will be remembered that Dr. Cook (who took part in the Belgian Antarctic Expedition) made the circuit of Mount McKinley in 1903 (*Journal*, vol. **24**, p. 592), and, though unable to complete the ascent on that occasion, reached a height of over 11,000 feet. The total height assigned to the mountain by the Geological Survey is 20,464 feet.

Drainage Modifications in the Black Hills and Bighorn Mountains.—Among the many studies of drainage modifications within recent geologic times which have been taken up with so much ardour on all sides, is one by Mr. G. R. Mansfield, in respect of the above-mentioned districts of the United States, which has appeared in the *Bulletin* of the Museum of Comparative Zoology at Harvard (Geol. Ser., vol. **8**, No. 3). A marked feature in portions of the Black hills district is the occurrence of beds of gravel and boulders, sometimes of great thickness, and occupying not only broad valleys like that of Boulder creek, but saddles on the divides and patches on the shoulders of the boundary slopes far above the present streams. Although the idea has been held that some, at least, of the deposits were formed on the shore of an ancient lake, Mr. Mansfield considers it preferable to regard them all as fluviatile in origin, the region having, since their formation, been subjected to considerable changes in its drainage system. The writer has carefully mapped the deposits, and compared the boulders collected with samples of rocks occurring *in situ* in the district, with the result that he has been able to lay down in a map the lines of movement from possible places of origin. These agree remarkably in indicating a source, in each case, roughly towards the south-west, and it may therefore be supposed that the ancient stream had its headwaters in this direction. But while both the drainage basin and direction of discharge have remained practically the same to the present day, the lines along which that discharge takes place are not identical. Mr. Mansfield believes that the Post-Oligocene incision, which has brought about the changes referred to, began as the result of an increase in relative humidity, but that later the process was continued as the result of tilting, which brought about readjustments of drainage. In the Bighorn mountains the history has been somewhat similar, extensive gravel deposits having accumulated during the Pleistocene period, since which the streams have entrenched themselves deeply below the old valley-floors. In this case, too, uplift, and not

climatic oscillation alone, seems to have played its part, and great opportunity has been given for the development of adjusted drainage, striking examples of which are given in the paper.

Nicaragua and the Mosquito Territory.—Last year, on April 19, a treaty was signed at Managua between Great Britain and Nicaragua, by which the former recognizes the absolute sovereignty of Nicaragua over the former Mosquito Reserve, as defined in the treaty of Managua (now abrogated) of January 18, 1860. Certain privileges are, on the other hand, secured to the Mosquito Indians and Creoles born before 1894, including exemption from military service and from all direct taxation for fifty years from the ratification of the treaty. This took place in August of the present year, and the text of the treaty has since been issued as No. 11 (1906) of the Treaty Series of Parliamentary papers.

AUSTRALASIA AND PACIFIC ISLANDS.

The First Crossing of Mount Cook.—The story of the first crossing of Mount Cook is told by Mr. Malcolm Ross in the May number of the *Alpine Journal*. The start was made by Messrs. Fyfe, Graham, Ross, and Turner on Tuesday, January 9, 11.15 p.m., from Bivouac rock on the Haast ridge, whence earlier climbers too have set out to scale the highest pinnacle of the Southern Alps. Leaving Glacier dome, 1300 feet above the Bivouac, ten minutes past midnight, and making a descent of 700 feet, the party went 4 miles across a plateau (7000 feet high) to the foot of the north-east ridge. Climbing the long snow-slope, they encountered in the eerie dusk before dawn a serious bergschrund. Deftly overcoming this, they were startled by an avalanche crashing with thunderous din from the ice-slopes of Mount Tasman to the plateau. Three hours twenty-five minutes' grim work from the schrund gained them the Zurbriggen arête. By 9 a.m. they stood 10,000 to 11,000 feet high, commanding views of Mount Tasman close on the north, Lendenfeldt, Haast, Haidinger, De la Bêche, Elie de Beaumont, and the Hochstetter dome. Across the valley towered Malte Brun. Farther away to the north-east stretched a 100-mile vista of range on range far as eye could reach. After an hour's rest, the party again set to cutting steps up another very sharp snow-ridge. Finally at 1 p.m., Wednesday, January 10, thirteen hours forty-five minutes from the time of leaving the Bivouac, the mountaineers put underfoot the topmost pinnacle of Aorangi, 12,397 feet above the sea. The mountain having been climbed from the Tasman side, it was boldly resolved to descend it on the Hooker side. This descent, perilous in places, was happily accomplished, and on Thursday morning, just after midnight, the mountaineers stepped on to the upper slopes of the Hooker glacier.

The Structure-lines of Oceania.—This is the subject of a paper by Dr. T. Arldt in Nos. 5 and 6 of the *Zeitschrift* of the Berlin Geographical Society for the present year, the object of which is to extend the investigations of Dana into the prevailing directions of the structure-lines of Oceania by a more detailed examination of the region. Dr. Arldt points out in an introductory section what diverse views have been held as to the past geological history of the Pacific, some holding that ocean to be the site of a vast former land mass, while others, adhering to the view of the permanence of ocean basins through long geologic ages, believe it to be the field of action of forces which have only in recent times begun to thrust up mountain ranges from below. A decision between these two opposite views is impossible in the existing state of our knowledge of the geology of the region; while the fact that the original formations of so large a part of the area are masked by deep-sea deposits makes it particularly difficult to gain an insight into the past physical history. The study of the structural lines observable in the island groups is therefore of special

importance. Dana, in his 'Manual of Geology,' pointed out the striking parallelism which prevails in the directions of such lines, and, in order to throw further light on this point, Dr. Arldt undertook the task of determining, for each group throughout the whole area, the direction of the loxodromes of the main tectonic lines, the angles being measured from north through east to south. He divides the whole area into an inner and outer arc—the former comprising all the groups nearest to the archipelago and Australia (Melanesia, New Zealand, etc.); the latter the Polynesian groups—with the additional arc of the Marianne islands showing special features of its own. This division accords in the main with the geological characteristics of the areas, the inner zone forming, *e.g.*, a wide girdle of Mesozoic and Tertiary folds ranged outside the pre-Carboniferous folded ranges of the Australian continent, and marked by volcanic activity and the depression of certain areas within it; it is to be regarded throughout as an old continental area. The character of the outer zone is not so clearly marked. The result of Dr. Arldt's calculations is to confirm the main theses laid down by Dana, though the parallelism is not always quite so striking as that writer supposed. Thus, in the case of the Polynesian groups the greatest difference of direction amounts to 21°, instead of the 8° which he supposed. Of Dana's characteristic directions (west-north-west and north-north-east), the former holds good for the outer zone as a whole, and in a less degree for the north-west part of Oceania as a whole; but the latter does not agree so well with the reality. Rectangular intersection of different systems is seen in a limited number of cases. Dr. Arldt thinks that, though the character of folded mountain ranges is not definitely established in the case of the groups of the outer zone, the parallelism is sufficiently striking to argue a unity of origin, and that the simplest explanation is that which attributes this to folding. The conformity of the island chains with the older mountain systems to the west, which recalls other examples in various parts of the world, points in the same direction. Thus we have a regular succession in time and place from the West Australian tableland through the Australian cordillera to the inner zone of islands, and it is only natural to extend the sequence to the outer zone also. If this is justified, that zone may perhaps represent the most recent fold-system on the face of the Earth, as it would also have the greatest longitudinal extension. This might be explained by the absence of checks to the forces in play in the case of so large an extent of ocean.

POLAR REGIONS.

Mr. Harrison's Expedition to Arctic Canada.—Writing from Herschel island on August 26, Mr. A. H. Harrison gives particulars of the work he has been able to accomplish since the beginning of March, the date of his previous letter (see *Journal*, vol. 27, p. 635). Survey work and geographical studies of various descriptions had continued fully to occupy Mr. Harrison's time. The greater part of the spring and summer months was spent on Herschel island, but in July Mr. Harrison took advantage of an opportunity which offered to secure a passage on board a whaler to Banks Land, and went up the coast as far as Cape Kellett. During the cruise, which occupied six weeks, useful information was obtained as to the character of the Arctic ice, on which Mr. Harrison often went out from the ship. He had hoped to obtain supplies from the whalers who had wintered at Baillie island, in the neighbourhood of Cape Bathurst, but found that they themselves had barely sufficient provisions for their own requirements. Consequently Mr. Harrison's idea of wintering on Banks Land had to be abandoned, and at the end of the cruise he returned to Herschel island. Among the fruits of the six months' work are maps of Baillie island (which, Mr. Harrison states, is wrongly located on the charts) and Herschel island, together with a series of soundings between the two islands, which

are important as providing the only two safe harbours along that part of the coast. Much time has also been devoted to observations of the drift of the ice in the neighbourhood of Herschel island. A south-east or north-east wind always drove the ice off in the direction of Point Barrow, and a south-west or north-west wind brought it back again. But there was almost always open water, or what appeared to be an open-water sky, to the north, and hence Mr. Harrison does not think it practicable to undertake a journey north over the ice in search of the land which he is confident exists in that direction. The conclusion at which he has arrived is that there is a drift to the north-east from Point Barrow, which meets the waters of the Mackenzie river somewhere to the north of Herschel island, whence, having no outlet to the north or east, the current is ultimately deflected into the line of drift of the *Jeannette* and the *Fram*. As regards his plans for the future, Mr. Harrison proposes to winter at the mouth of the Mackenzie river, and in the spring to undertake a journey eastwards, returning along the coast over the Arctic ice. Then in the summer the whalers will bring him fresh supplies from San Francisco, and carry him to Banks Land. Mr. Harrison has engaged the services of two Eskimo families, who will accompany him north, women as well as men. The former are not only a necessary adjunct to the expedition—since the men will not go without them—but are expected to be of the greatest assistance; not inferior to the men in endurance, they are far superior to them in industry. Mr. Harrison is acquiring a speaking knowledge of the Eskimo language, which will, no doubt, stand him in good stead in his ethnographical investigations.

The Flora of Ellesmere Land and its Affinities.—The second part of the report of the second Norwegian Arctic Expedition in the *Fram* consists of a memoir by Mr. H. G. Simmons, the botanist of the expedition, on the Vascular Plants in the flora of Ellesmere Land (Christiania: A. W. Brøgger, 1906). The writer has not been content to study his own collections only, but has made himself thoroughly acquainted with all the data previously brought together on the subject, having spent some time in London for the purpose of studying the collections made by British expeditions. The memoir consists of scientific descriptions of the species represented, with careful definition of the localities and range of each. A short introduction discusses, however, the general questions of the composition and affinities of the flora, besides sketching the history of botanical research in the area studied. The sixty-nine species known to Sir Joseph Hooker when discussing the botany of the Nares Expedition, have now been increased to a hundred and fifteen, not including ten which Mr. Simmons regards as doubtful, the orders represented by the greatest number of species being *Gramineæ*, *Cyperaceæ*, *Cruciferæ*, *Saxifragaceæ*, and *Caryophyllaceæ*. Only two of the genera are not present in Greenland, and only two species of other genera, so that Hooker's opinion that the flora of Ellesmere Land is entirely Greenlandic would seem to be fully borne out. But Mr. Simmons points out that a further examination is necessary before concluding that the dividing line (if such exists) between a European flora in Greenland and an American one further west is deflected so as to include Ellesmere Land with the former and separate it from the other Arctic islands. He shows that, apart from the circumpolar species, the character of the flora is as decidedly American as Greenlandic, and that there are definite indications that certain of the species have entered from the south-west. The explanation is that the affinity noted is with the flora of *north-west* Greenland, which itself shows clearly the influence of the near neighbourhood of the American flora, many species having evidently made their way in from Ellesmere Land. The Greenland flora is, in fact, no unity, but consists of several diverse elements.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Incised Meandering Valleys.—In the Bulletin of the Geographical Society of Philadelphia (vol. 4, No. 4), Prof. W. M. Davis contributes some further investigation on the formation of meandering valleys where a serpentine river has been impelled by regional uplift to erode a new valley above the level of its earlier valley floor. Beginning with a symmetrical diagram of an incised meandering valley, in which the meanders are considered as stationary, he points out that, under natural conditions, the meanders tend to migrate down the valley, with the result that the spurs have a steeper undercut slope on the up-valley side, and a slip off gravel-strewn slope on the down-valley side. This he further illustrates by a diagram of the successive positions of a meandering stream. He points out that the rates of corrasion (vertical, lateral outward, and lateral down-valley-ward) vary absolutely and in relation to one another. An important point is that in the earlier stages of valley erosion it is the down-valley-ward corrasion that is largely responsible for the trimming and gradual removal of the spurs, whereby a narrow, incised, meandering valley is converted into an open flood-plain valley. Several diagrams which follow illustrate the combined action of outward and down-valley-ward corrasion. Prof. Davis urges the further study of rivers from these points of view in the field, pointing out that topographical maps are rarely accurate enough to exhibit all the significant features. At present the student of meandering valleys must go into the field for facts. He instances certain rivers which are especially interesting in this connection, such as the Potomac, the Juncata, the Chatanqua creek, the north branch of the Susquehanna, and the river valleys of the High Eifel and Ardennes.

GENERAL.

Queensland Geographical Society.—In the last week of June the Queensland branch of the Royal Geographical Society of Australia celebrated the twenty-first anniversary of its foundation. The celebrations extended over four days, and comprised a series of meetings of the society at Brisbane, interspersed with a variety of social functions. To judge from the reports in the *Brisbane Courier*, the meetings and festivities not only aroused much public interest, but were of a character to give a worthy stimulus and inspiration to geographical workers in Queensland. The proceedings commenced on Tuesday, June 26, with a reception and luncheon by the Mayor of Brisbane, and terminated on Friday evening with a conversazione. On intermediate days members and delegates were entertained at a river-picnic on board the Government yacht by the council of the society, and at a garden-party given by the governor, Lord Chelmsford, who has accepted the office of President in succession to the late Sir Hugh Nelson, whose death was recorded in the April number of the *Journal*. The first meeting in connection with the celebrations was held on Tuesday evening, when the honorary secretary, Dr. J. P. Thomson, who took a leading part in founding the society, and who has been largely responsible for its successful working, read a number of congratulatory messages from geographical societies and other learned bodies all over the world, including one from our own society. Subsequently Dr. Thomson read a paper reviewing at considerable length the activities of the society during the twenty-one years of its existence. He emphasized the fact that "from the first the cardinal principles of universal geography were set up for the guidance of the society, and a broad and comprehensive policy in the acquisition and dissemination of geographical knowledge was adopted;" and was able to show that, in spite of initial difficulties, much good work has been accomplished. The principal feature of the meeting on the following evening was the presentation to the consideration of the society of the valuable paper on

the "Present Problems of Geography," which Dr. H. R. Mill read before the Eighth International Geographical Congress; while on Thursday evening there was read, again in the absence of the author, a paper discussing the question of geographical education in schools and colleges, by Dr. Richard Elwood Dodge, Professor of Geography in the Teachers' College, Columbia University, New York. Finally, on Friday there was presented to the society a paper by Sir John Murray, written specially for the anniversary celebrations, dealing with the observations as to the depth of the ocean lying to the east of Australia, the temperature of the waters of the ocean, the marine deposits which cover the floor of the ocean, and the percentage of carbonate of lime which is contained in these deposits. One of the conclusions reached by Sir John Murray is that in the region under consideration—namely, that portion of the South Pacific bounded on the west by the coasts of Tasmania, Australia, and New Guinea, on the north by the equator, on the east by the meridian of 160° W. long., and on the south by the parallel of 50° S. lat.—it may be roughly estimated that of the total water area, about 25 per cent. is under 1000 fathoms in depth, about 20 per cent. between 1000 and 2000 fathoms in depth, about 40 per cent. between 2000 and 3000 fathoms in depth, and about 15 per cent. over 3000 fathoms in depth.

OBITUARY.

H. W. Cadoux.

We regret to record the death of Mr. H. W. Cadoux, a young traveller of much promise, who had already gained a close knowledge of considerable portions of Western Asia, and at the time of his death was hoping to do further geographical work in the same region. He had also resided for some time in Rhodesia, and had carried out surveys in Manicaland and along the Portuguese frontier. His principal work had, however, been done in Trans-Caucasia and Asiatic Turkey. In the former he had resided some seven years, travelling extensively in the eastern portion, and studying in particular the Mohammedan populations and their languages, including one of the old Persian colonies on the southern slopes of the main chain. In June, 1892, he ascended to the summit of Mount Ararat, his visit falling between those of Markoff and Pastukhoff, the latter of whom alluded to it while describing his own ascent. Mr. Cadoux also travelled in Mesopotamia, and his interesting paper on changes in the course of the lower Euphrates, in the September number of the *Journal*, shows him to have been a keen and capable observer.

Dr. Karl Futterer.

The well-known traveller in Central Asia, Dr. Karl Futterer, died in February last at the early age of thirty-nine years, having for some time past suffered from serious ill health. The important journey which he carried out in 1897–99, in company with Dr. Holderer, across the whole length of Asia, was alluded to at the time in the *Journal* (see especially vol. **12**, p. 520; vol. **13**, p. 430). It was particularly fruitful in scientific observations, Dr. Futterer being a trained geographer and geologist, while he paid attention also to the botanical, zoological, and meteorological characters of the countries passed through. Besides a number of papers in scientific periodicals, he had brought out a portion of a large work on the results of his expedition (*Journal*, vol. **18**, p. 525), though his ill health had, unfortunately, delayed the issue of the remainder. It is hoped, however, that this may still be

made available, Dr. F. Noetling having undertaken to prepare it for publication. A portrait of the traveller is given in the *Deutsche Rundschau für Geographie* for July last.

CORRESPONDENCE.

African Languages.

THE importance of language in relation to political and social aspects of the native question in Africa seems liable to be overlooked. The possibility of large groups of tribes, hitherto distinct and mutually antagonistic, becoming rapidly able and eager to understand each other in some common form of speech, has apparently to be taken into account. Twenty-six years' contact with Swahili and various dialects of Eastern and Central Africa points so far to the conclusion that there is a remarkable degree of similarity, amounting in many important respects to substantial identity, in the grammatical structure of language over the whole vast area occupied by the Bantu races of Africa, from the Sudan to the Cape. And the stock of words common to all Bantu tribes, when recognized under their various dialectic disguises, will probably prove very considerable.

The officials, missionaries, traders, settlers, and travellers of various nationalities who are qualified to give help in testing this conclusion by personal and first-hand study of a Bantu dialect are naturally difficult to reach, scattered in remote and often isolated spheres of work. It is, therefore, perhaps justifiable to ask publicity for the request, that persons so qualified and willing to accept and reply to a brief communication on the subject would send me their addresses at Fort Jameson, North-Eastern Rhodesia.

I should be grateful if foreign journals and local papers in Africa, general and official, would assist by calling attention to my invitation.

A. C. MADAN,
Student of Christ's Church, Oxford.

c/o The British South Africa Company,
Fort Jameson, North-Eastern Rhodesia,
July 12, 1906.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C. R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological, etc.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps—Glaciers. **Forel, Lugeon, and Muret.**

Jahrb. Schweiz. Alpenclub **41**, 1905 (1906): 268–287.

Les variations périodiques des glaciers des Alpes. Par Dr. F. A. Forel, Dr. M. Lugeon, E. Muret. 26me rapport, 1905.

Alps—Meteorology. *Met. Z.* **23** (1906): 193–200. **Ficker.**

Der Föhn vom 4. bis 6. November 1905 in den Ostalpen. Von H. von Ficker.

Alps—Simplon. *Mouvement G.* **23** (1906): 259–262. **[Wauters.]**

Le Simplon. Par A. J. W. *With Maps.*

Alps—Vegetation. **Pampanini.**

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Alps—Vegetation. **Schroeter.**

Das Pflanzenleben der Alpen. Eine Schilderung der Hochgebirgsflora von Dr. C. Schroeter. Dritte Lieferung. Zürich: A. Raustein, 1906. Size 9½ × 6½, pp. 249–344. *Illustrations. Price* 3*s.*

This important work will be reviewed on its completion by the issue of part 4.

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Revision der Luftdruck-Jahresmittel österreichischer Stationen 1886 bis 1904. Von Dr. M. Margules.

Austria—Meteorology. ———

Jahrbücher der K.K. Zentral-Anstalt für Meteorologie und Geodynamik. Jahrg. 1904. N. F. xli. Band, and Anhang. Wien: W. Braumüller, 1906. Size 12 × 9½, pp. xxx., 132, 106, 32, and 24; Anhang, 42.

Belgium—Scheldt. *B.S.G. Lille* **45** (1906): 237–244. **Blanchard.**

A propos les inondations récentes dans les Polders du Bas-Escaut. Par Raoul Blanchard. *With Illustrations.*

Carpathians. *C. Rd.* **142** (1906): 1583–1585. **Martonne.**

Sur deux plans en relief du Paringu et de Soarbele (Karpates méridionales) exécutés d'après des levés topographiques inédits. Note de E. de Martonne.

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Streifzüge in den Liptóer Karpathen. Von Karl Siegmeth.

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The Development of Agriculture in Denmark. By R. J. Thompson.

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Les terrasses de la vallée du Rhône en aval de Lyon. Note de M. de Lamothe.

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Le Nord et l'Est de la France et les Voies d'accès au Simplon. *Map.*

France—Durance. *B.S.G. Marseille* **29** (1905): 257–264. **Repelin.**

Les Sources de la Durance. Par J. Repelin. *With Sketch-map.*

The author holds, with Reclus and others, that the Clarée is the true upper course of the Durance.

France—Nord. *Suppl. B.S.G. Lille* (1906): pp. 80. **Blanchard.**
La densité de Population du Département du Nord au XIX^e^ siècle. Étude de dix recensements de population. Par R. Blanchard. *With Diagrams.*

France—Ports. *B.S.G. Lille* **45** (1906): 221–233. **Cloarec.**
Les grands ports de guerre et de commerce de la France. Par P. Cloarec. *With Illustrations.*

Germany—Bavaria. *M.G. Ges. München* **1** (1906): 501–560. **Reindl.**
Dörfer, Weiler und Einzelhöfe in Südbayern. Eine anthropogeographische Studie zur Kenntnis der Siedelungsverhältnisse in Südbayern. Von Dr. J. Reindl.

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Studien am Ammersee in Oberbayern. Von W. Ule. *With Map.*

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Agriculture in the Rhenish Province. Foreign Office, Miscellaneous, No. 652, 1906. Size 10 × 6½, pp. 50. *Price* 3*d.*

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Resultate der wissenschaftlichen Erforschung des Balatonsees. . . . Herausgegeben von der Balatonsee-Commission der Ung. Geographischen Gesellschaft. Erster Band. Physische Geographie des Balatonsees und seiner Umgebung. Vierter Theil. Dritte Section. Resultate der Phytophänologischen Beobachtungen in der Umgebung des Balatonsees. Aus dem Nachlasse des weil. Dr. Moriz Staub in druck gelegt von Dr. J. Bernátsky.—Fünfter Theil . . . Zweite und Dritte Section. Die Farbenerscheinungen des Balatonsees, von Dr. E. v. Cholnoky und die Reflexionserscheinungen an bewegten Wasserflächen, von Dr. Baron Béla Harkányi.—Zweiter Band. Die Biologie des Balatonsees und seiner Umgebung. Erster Theil . . . Anhang: Beiträge zur Kenntniss des Planktons, von Dr. Géza Entz, jun.; und I. und II. Nachtrag zur Aufzählung der Weichthiere, von Dr. A. Weiss und T. Kormos.—Zweiter Theil . . . 1 Section. Anhang: Die Bacillarien des Balatonsees, von Dr. J. Pantocsek.—Dritter Band. Social- und Anthropogeographie des Balatonsees. Erster Teil. Archæologie der Balatonsee-Umgebung. Erster Section. Archæologische Spuren aus der Urzeit und dem Altertum bei Veszprém, von G. Rhé.—Zweiter Theil. Ethnographie der Umwohner des Balatongestades, Dr. J. Jankó. Nach dem Tode des Verfassers deutsch bearbeitet, von Dr. W. Semayer.—Fünfter Theil: Bibliographie des Balatonsees, von Dr. J. v. Sziklay. Wien: E. Hölzel, 1902–1906. Size 11½ × 8½. *Maps and Illustrations.* Topographischer und geologischer Atlas. I. Theil. . . . Entworfen von Ludwig von Loczy, 1903. Size 21½ × 28½. *Presented by the Société Hongroise de Géographie.*

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Tertiary and Recent Glaciation of an Icelandic Valley. By H. G. Ferguson. *With Map and Illustrations.*

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The Battlefields of North Italy. By Lieut.-Colonel the Hon. E. Noel. *With Map.*

Italy—Calabria. *B.S.G. Italiana* **7** (1906): 432–459. **Baratta.**
I terremoti di Calabria. Conferenza del dott. M. Baratta. *With Maps and Diagram.*

Italy—Rome. *M.K.K.G. Ges. Wien* **49** (1906): 118–136. **Hartung.**
Einiges Neuere über das antike und das heutige Rom. Von C. Hartung Edler von Hartungen jun. *With Plans.*

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Agriculture of Tuscany. Foreign Office, Miscellaneous, No. 648, 1906. Size 10 × 6½, pp. 16. *Price* 1*d.*

Italy—Vesuvius. *C. Rd.* **143** (1906): 13–18. **Lacroix.**
Les produits laviques de la récente éruption du Vésuve. Note de A. Lacroix.

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Sur les relations tectoniques et stratigraphiques de la Sicile et de la Tunisie. Note de É. Haug.

Northern Europe—Zoogeography. **Ekman.**

Die Phyllopoden, Chadoceren und freilebenden Copepoden der nordschwedischen Hochgebirge. Ein Beitrag zur Tiergeographie, Biologie und Systematik der arktischen, nord- und mittel-europäischen Arten. Inaugural-Dissertation zur Erlangung der Doktorwürde . . . von Sven Ekman. Naumburg a. S., 1904. Size 9 × 6½, pp. 170. *Plates.*

Norway and Sweden—Ecology. **Haglund.**

Ur de högnordiska vedväxternas Ekologi. Akademisk Afhandling af Emil Haglund. Uppsala: K. W. Appelberg, 1905. Size 10 × 7, pp. 78. *Illustrations.*

On the life-conditions of woody plants in high northern latitudes.

Norway and Sweden—Zoogeography. **Lönnberg.**

Arkiv. för Zoologi **3** (1906): No. 9, pp. 19.

On the geographic races of red deer in Scandinavia. By Einar Lönnberg. *With Illustrations.*

Russian Empire. *Ann. de G.* **15** (1906): 9–25. **Aïtoff.**

Peuples et Langues de la Russie d'après les données du premier recensement russe exécuté en 1897. Par D. Aïtoff. *With Map.*

Spain. *Tour du Monde* **11** (1905): 577–624; **12** (1906): 121–168. **Dieulafoy.**

De Tolède à Grenade. Par M^me^ Jane Dieulafoy. *With Illustrations.*

Switzerland. *B.S.R. Belge G.* **30** (1906): 73–97. **Clerget.**

Le peuplement de la Suisse. (Étude de géographie humaine.) Par Pierre Clerget.

Referred to in the Monthly Record (October, p. 396).

Switzerland—Lakes. **Bourcart.**

Les lacs Alpins Suisses. Étude chimique et physique. Par le Dr. F. E. Bourcart. Genève: Georg & Co., 1906. Size 12½ × 9½, pp. 130. *Illustrations. Presented by the Author.*

Turkey—Macedonia. **Cvijić.**

Remarks on the Ethnography of the Macedonian Slavs. By Dr. J. Cvijić. (Translated from the Second Revised Edition.) London: Horace Cox, 1906. Size 10 × 6½, pp. 38. *Two copies. Presented by the Author.*

United Kingdom—Canterbury.

Canterbury, Mother-city of the Anglo-Saxon race. Published by the Canterbury Chamber of Trade, with the Co-operation and Assistance of the Corporation of the City. Canterbury: Cross & Jackman, [*not dated*]. Size 12 × 9, pp. 134. *Map, Plan, and Illustrations.*

United Kingdom—Devon. **Lowe.**

Old Lamps or New? Another Contribution to Devonshire Controversial Geology. By Harford J. Lowe. [Extracted from the *Geological Magazine*, Decade v. vol. 2, No. 492, June, 1905.] London, 1905. Size 8½ × 5½, pp. [9]. *Presented by the Author.*

Questions the modern view that the clays and sands of the Bovey area are Eocene and contemporaneous with those of the Hampshire basin.

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The Botanical Geography of a Penine Stream. By C. E. Moss. *With Illustrations.*

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Memoirs of the Geological Survey, England and Wales. Explanation of Sheets 326 and 340. The Geology of the country near Sidmouth and Lyme Regis. By H. B. Woodward and W. A. E. Ussher. With Contributions by A. J. Jukes-Browne. London: E. Stanford, 1906. Size 10 × 6, pp. vi. and 96. *Illustrations. Price* 1*s. Presented by the Geological Survey.*

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The British Academy. The Romanization of Roman Britain. By F. J. Haverfield. (From the *Proceedings of the British Academy*, vol. 2.) London: H. Frowde, [*not dated*]. Size 10 × 6½, pp. 34. *Illustrations. Price* 2*s.* 6*d. net. Presented by the Publisher.*

United Kingdom—Humber. *Trans. Hull. Geol. S.* **6** (1901–05): 33–37. **Butterfield.**
Islands in the Humber. By A. E. Butterfield. *With Maps.*

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Department of Agriculture and Technical Instruction for Ireland. Fifth Annual General Report of the Department, 1904–05. Dublin: E. Ponsonby, 1906. Size 9½ × 6, pp. viii. and 494.

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Notes on the Corries of the Comeragh Mountains, Co. Waterford. By F. R. Cowper-Reed. *With Maps and Plate.*

United Kingdom—Ireland—Botany. *P.R. Irish A.* **26**, Sec. B. (1906): 14–45. **Praeger.**
Irish Topographical Botany: Supplement, 1901–1905. By R. L. Praeger.

United Kingdom—Leeds. **[Graham.]**
Memorandum on the Industries of Leeds. [By James Graham.] [Leeds, 1905.] Size 10½ × 8½, pp. 8. *Map. Presented by the Higher Education Committee, Leeds.*
The maps show the space-distribution of the chief industries according to number of workers.

United Kingdom—London. **Prideaux.**
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Notes on Salway's Plan of the Road from Hyde Park Corner to Counter's Bridge. By Colonel W. F. Prideaux.

United Kingdom—London. ——.
London Topographical Record, Illustrated; including the Fifth and the Sixth Annual Report of the London Topographical Society. Vol. 3. (Issued for the years 1903–1904.) London, 1906. Size 9 × 5½, pp. 184. *Plans and Illustrations. Presented by the London Topographical Society.*

United Kingdom—Meteorology. ——
Meteorological Observations at Stations of the Second Order for the Year 1901. Edinburgh; London: Wyman & Sons, 1906. Size 12½ × 10, pp. xiv. and 180. *Map. Price* 22*s.* 6*d. Presented by the Meteorological Office.*

United Kingdom—Meteorology. ——
Report of the Meteorological Council for 1905, to the President and Council of the Royal Society. London: Wyman & Sons, 1906. Size 10 × 6½, pp. 228. *Maps. Price* 1*s.* 5*d. Presented by the Meteorological Office.*

United Kingdom—Scotland. *Scottish G. Mag.* **22** (1906): 322–324. **Frew and Mort.**
The Southern Highlands from Dumgoyn. By J. Frew and F. Mort. *With Illustrations.*

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The History of the Scottish Peat Mosses and their relation to the Glacial Period. By F. J. Lewis. *With Diagram and Illustrations.*
Cf. note in the *Journal*, vol. **27**, p 84.

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The Kingussie District: a geographical Study. By Marion I. Newbigin, D.Sc. *With Map and Illustrations.*

United Kingdom—Scotland. *Scottish G. Mag.* **22** (1906): 229–241. **Hardy.**
Botanical Survey of Scotland. A General Map of the Highlands, with a Sketch of the History and Methods. By Dr. M. Hardy. *With Maps and Diagrams.*

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In the Heart of the Coolins.

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The Pendleton Earth-shake of November 25, 1905. By Dr. C. Davison. *With Diagrams.*

United Kingdom—Suffolk. **Whitaker and Others.**
Memoirs of the Geological Survey. England and Wales. The Water Supply of Suffolk from underground sources; with records of sinkings and borings. By William Whitaker, F.R.S., with Contributions by Dr. H. F. Parsons, Dr. H. R. Mill,

and Dr. J. C. Thresh. London: E. Stanford, 1906. Size 10 × 6¼, pp. vi. and 178. *Map. Price* 3*s.* 6*d. Presented by the Geological Survey.*

United Kingdom—Waterways. **Saner.**
Minutes P.I. Civil Engineers **163** (1906): 21–161.
On Waterways in Great Britain. By J. A. Saner. *With Maps and Sections.*

United Kingdom—Yorkshire. *Trans. Hull Geol. S.* **6** (1901–05): 58–64. **Crofts.**
Notes on the indications of a Raised Beach at Heasle. By W. H. Crofts. *With Plates.*

United Kingdom—Yorkshire. *Trans. Hull Geol. S.* **6** (1901–05): 43–57. **Sheppard.**
List of Papers, Maps, etc., relating to the Erosion of the Holderness Coast, and to Changes in the Humber Estuary. Compiled by T. Sheppard.

United Kingdom—Yorkshire. *P. Yorkshire Geol. S.* **15** (1905): 388–410. **Carter.**
The Evolution of the Don River-system. By W. Lower Carter. *With Maps and Illustration.*

United Kingdom—Yorkshire. *P. Yorkshire Geol. S.* **15** (1905): 411–436. **Carter.**
The Glaciation of the Don and Dearne Valleys. By W. Lower Carter. *With Maps and Illustrations.*

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Ingleborough. Part ii. Stratigraphy (continued). The Silurian Rocks of Ingleborough. By T. McKenny Hughes. *With Plans and Sections.*

United Kingdom—Yorkshire. *P. Yorkshire Geol. S.* **15** (1905): 446–452. **Sewell.**
Notes on the "Overflow Channel" in Newton Dale between Lake Wheeldale and Lake Pickering. By J. T. Sewell. *With Map.*

ASIA.

China. *Z. Ges. E. Berlin* (1906): 356–365. **Tafel.**
Dr. Tafel's weitere Reisen in Nord-China.
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Eastern Asia. **Doflein.**
Ostasienfahrt. Erlebnisse und Beobachtungen eines Naturforschers in China, Japan, und Ceylon. Von Dr. Franz Doflein. Leipzig und Berlin: B. G. Teubner, 1906. Size 10 × 7, pp. xiv. and 512. *Illustrations. Price* 13*s.*
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Eastern Asia. **Maidel.**
Physico-Geographical Sketch of the China and Yellow Sea. By Major-General Baron E. Maidel . . . Edited by T. B. von Spindler. [In Russian.] St. Petersburg, 1904. Size 10 × 6¼, pp. viii. and 122. *Charts and Illustrations.*

French Indo-China. *B.S.G. Lille* **45** (1906): 207–220. **Simon.**
L'Œuvre Française sur le Haut-Mékong de 1893 à 1905. Par le Lieutenant de Vaisseau Georges-E. Simon. *With Illustrations.*

French Indo-China—Cartography. *Ann. de G.* **15** (1906): 26–42. **Rouget.**
Étude sur la cartographie de l'Indo-Chine française. Par le Capitaine Rouget.

French Indo-China—Tongking. *B.S.G. Marseille* **29** (1905): 279–294. **Gérard.**
L'Industrie des Pêches maritimes au Tonkin. Par André Gérard.

India. *J. and P. Asiatic S. Bengal* **1** (1905): 230–235. **Molony.**
Some remarks on the Geology of the Gangetic Plain. By E. Molony. *With Map.*

India—Bombay.
Gazetteer of the Bombay Presidency. Vols. 2 B–6 B, 10 B–13 B, and 15 B–24 B. Bombay, 1904–1905. Size 10 × 6. *Presented by the India Office.*

India—Burma. *Records Geol. Surv. India* **33** (1906): 49–54. **La Touche.**
Note on the Natural Bridge in the Gokteik Gorge. By T. D. La Touche. *With Plan and Illustrations.*

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On Recent Changes in the Course of the Nam-tu River, Northern Shan States. By T. D. La Touche. *With Map.*

India—Coorg. ——
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Pleistocene Movement as indicated by Irregularities of Gradient of the Narbada and other Rivers in the Indian Peninsula. By E. Vredenburg. *With Map, Illustration, and Diagrams.*
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India—Himalayas. *Jahrb. Schweiz. Alpenclub* **41**, 1905 (1906): 190–205. **Guillarmod.**
Vers le Kangchinjunga (8585m), Himalaya népalais. Par le Dr. J. Jacot Guillarmod. *With Plates.*

India—United Provinces. **Nevill.**
District Gazetteers of the United Provinces of Agra and Oudh. Vol. **42**, Kheri (pp. 252, xxxviii., and viii.); vol. **43**, Fyzabad (pp. 282, xlii., and viii.); vol. **44**, Gonda (pp. 276, xlii., and viii.) Compiled and edited by H. R. Nevill. Allahabad and Naini Tal, 1905. Size 9 × 6. *Maps. Presented by the India Office.*

Malay Archipelago—Java. **Klerck.**
De Java-Oorlog van 1825–30, door E. S. de Klerck. Vierde Deel. Batavia: 's Hage, M. Nijhoff, 1905. Size 11 × 7½, pp. xxvi. and 898. *Maps. Presented by the Bataviaasch Genootschap van Kunsten en Wetenschappen.*

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The Philippine Islands, 1493–1898. Edited by E. H. Blair and J. A. Robertson, with . . . notes by E. G. Bourne. Vols. **26–35** (1519–1649). Cleveland, Ohio: The A. H. Clark Co., 1905–1906. Size 9½ × 6. *Facsimile Maps and Illustrations. Price $4 net per volume.*

Philippine Islands. *Vierteljahrs. Naturf. Ges. Zürich* **50**, 1905 (1906): 321–488. **Usteri.**
Beiträge zur Kenntnis der Philippinen und ihrer Vegetation, mit Ausblicken auf Nachbargebiete. Von A. Usteri. *With Map and Illustrations.*

Russia—Caucasus. **Bush.**
Mem. Imp. Russ. G.S., Gen. G. **32** (1905): No. 4 (pp. ii. and 136).
The Glaciers of the Western Caucasus. By N. A. Bush. [In Russian.] *With Plates.*

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Im Zentralen Kaukasus. Von A. Weber. *With Illustrations.*

Russia—Siberia. *G.Z.* **12** (1906): 155–161. **Sieroszewski.**
Die jakutischen Küsten des nördlichen Eismeeres. Von W. Sieroszewski.

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La grande Voie fluviale de Russie en Extrême-Orient. *With Map.*
Describes steps and proposals for improving communication by means of the great Siberian rivers.

Russia—Siberia—Communications. *Rev. Français* **31** (1906): 207–216. **Servigny.**
Le Transsibérien et l'Expedition Russe de l'Iénisséi. Par J. Servigny. *With Map.*

Turkey—Arabia. *Z. Ges. E. Berlin* (1906): 305–322. **Burchardt.**
Ost-Arabien von Basra bis Maskat auf Grund eigener Reisen. Von H. Burchardt. *With Illustrations.*

Turkey—Asia Minor. *G.Z.* **12** (1906): 185–193. **Braun.**
Von der anatolischen Riviera. Von F. Braun. *With Illustrations.*

Western Asia—Seistan. *J. S. Arts* **54** (1906): 657–666. **McMahon.**
Seistan: Past and Present. By Sir Henry McMahon.

AFRICA.

Africa—Communications. *B.S.G. Commerciale de Paris* **28** (1906): 217–235. **Salesses.**
Les chemins de fer africains. Par E. Salesses.

Cape Colony—Geology. *Rep. Brit. Ass., South Africa*, 1905 (1906): 394-396. **Du Toit.**
The Stormberg Formation in the Cape Colony. By Alex. L. du Toit.

Congo State—Katanga. *B.S. Belge d'Etudes Col.* **13** (1906): 329-352. **Buttgenbach.**
L'Avenir Industriel du Katanga. Par H. Buttgenbach. *With Map and Illustrations.*

East Africa. *M.G. Ges. München* **1** (1906): 637-660. **Weber.**
Die petrographische Ausbeute der Expeditionen O. Neumann—v. Erlanger nach Ostafrika und Abessynien 1900-1901. Von M. Weber. *With Map.*

Egypt—Meteorology. ———
The Meteorological Report for the year 1903. The Survey Department, Finance Ministry, Cairo. Cairo, 1905. Size 7½ × 11, pp. 212. *Diagrams.*

Egypt—Sinai Peninsula. ———
Egypt. No. 2 (1906). Correspondence respecting the Turco-Egyptian Frontier in the Sinai Peninsula. London: Wyman & Sons, 1906. Size 13 × 8½, pp. 36. *Map. Price* 6½*d.*
See note in the September number (p. 290).

Egyptian Sudan. *National G. Mag.* **17** (1906): 241-267. **Bridgman.**
The New British Empire of the Sudan. By H. L. Bridgman. *With Map and Illustrations. Also separate copy, presented by the Author.*

German East Africa—Meteorology. **Heidke.**
Mitt. a.d. Deuts. Schutzgeb. **19** (1906): 40-106.
Meteorologische Beobachtungen aus Deutsch-Ostafrika. Zusammenstellungen von Monats- und Jahresmitteln aus den Jahren 1899 bis 1902 von 22 Beobachtungsstationen. Von Dr. P. Heidke.

German South-West Africa. *Globus* **89** (1906): 207-209. **Gessert.**
Die Tafelgebirge des Hanami-Plateaus. Von F. Gessert.

Ivory Coast. *B.S.G. Com. Paris* **28** (1906): 289-312. ———
Notes sur la Haute Côte d'Ivoire. Par Capitaine E. A. S.

Kamerun and French Congo. *Mitt. a.d. Deuts. Schutzgeb.* **19** (1906): 1-30. **Kund.**
Bericht über eine Bereisung der deutsch-französischen Grenze zwischen Schari-Logone-Tuburi. Von Leutnant Kund. *With Map.*

Madagascar. *C. Rd.* **142** (1906): 1139-1141. **Colin.**
Travaux géodésiques et magnétiques aux environs de Tananarive. Note de E. E. Colin.

Morocco. **Lemoine.**
Paul Lemoine. Mission dans le Maroc Occidental (Automne, 1904). Rapport au Comité du Maroc. Paris, 1905. Size 8½ × 5½, pp. 224. *Maps, Sections, and Illustrations. Price* 3 *fr. Presented by the late Budgett Meakin, Esq.*

Sahara. *B.S.G. Italiana* **7** (1906): 104-110. **Jaja.**
Il valore economico del Sahara e i risultati della missione Foureau-Lamy. Comunicazione del dott. G. Jaja.

South Africa. *M.V. Erdk. Dresden* (1906): 38-70. **Beck.**
Ueber eine Fahrt durch Südafrika. Von Richard Beck. *With Illustrations.*

South Africa. *Geol. Mag.* **3** (1906): 97-104, 161-168. **Hatch**
The Geological History of South Africa. By Dr. F. H. Hatch.

South Africa. *Transvaal Agricultural J.* **4** (1906): 531-535. **Braine.**
Dongas: their effect and treatment. By C. D. H. Braine. *With Illustrations.*
Dongas are deep trenches cut by floods, which do great damage by draining all the moisture out of adjacent lands. Their formation has been largely due to reckless destruction of trees. The illustrations give some excellent examples of surface denudation.

South Africa—Geodesy. *Rep. Brit. Ass., South Africa*, 1905 (1906): 228-248. **Gill.**
On the Origin and Progress of Geodetic Survey in South Africa, and of the African Arc of Meridian. By Sir David Gill. *With Map. Also separate copy.*

South Africa—Kalahari. *Ann. de G.* **15** (1906): 43-58. **Demangeon.**
Le Kalahari, d'après le livre de M. Siegfried Passarge. Par A. Demangeon.

South Africa—Zambesi. **Lamplugh.**

Rep. Brit. Ass., South Africa, 1905 (1906): 292–301.

Report on the Investigation of the Batoka Gorge and adjacent portions of the Zambesi Valley. By G. W. Lamplugh. *With Sketch-map. Also separate copy, presented by the Author.*

South-East Africa—Historical. **Theal.**

Records of South-Eastern Africa, collected in various Libraries and Archive Departments in Europe by George McCall Theal, LL.D. Vols. 1-9. [Vol. 7 includes "Eastern Ethiopia," by Friar João dos Santos, in Portuguese and English.] Printed for the Government of the Cape Colony, 1898–1903. Size 9 × 6. *Chart and Plan. Presented by the Government of Cape Colony.*

Sudan—Geology. *C. Rd.* **142** (1906): 668–669. **Petit and Courtet.**

Les sédiments à Diatomées de la région du Tchad. Note de P. Petit et H. Courtet.

Togo—Rainfall. **Danckelman**

Die Niederschlagsverhältnisse des Schutzgebietes Togo. Von Dr. von Danckelman. (*Meteorologische Zeitschrift*, Hann-Band, pp. 145–151.) Braunschweig: F Vieweg und Sohn, 1906. Size 12 × 8. *Map.*

Transvaal. **Hall.**

Mines Department. Geological Survey of the Transvaal. The Geology of Pretoria and Neighbourhood: an Explanation of the Geological Map of the Environs of Pretoria. By A. L. Hall. Pretoria, 1905. Size 10 × 6, pp. viii. and 56. *Illustrations. Presented by the Mines Department, Geological Survey of the Transvaal.*

Transvaal. ———

Transvaal Department of Agriculture. Annual Report of the Director of Agriculture. 1904–1905. Pretoria, 1906. Size 10 × 6½, pp. 486. *Maps and Illustrations.*

Transvaal—Geology. **Kynaston.**

The Geology of the Komati Poort Coal-field. By H. Kynaston. (Transvaal Mines Department, Geological Survey, Memoir No. 2.) Pretoria, 1906. Size 9½ × 6, pp. 56. *Maps, Sections, and Illustrations.*

Transvaal—Swaziland. *Transvaal Agricultural J.* **4** (1906): 515–524. **Miller.**

Swaziland. Its Agricultural and Pastoral Future. By A. M. Miller. *With Illustrations.*

Tripoli. *Tour du Monde* **12** (1906): 49–84. **Mathuisieulx.**

Le Djebel Tripolitain et le Soff-ed-Jinn. Por M. de Mathuisieulx. *With Map and Illustrations.*

Tunis. *A travers le Monde* **12** (1906): 97–100, 105–108. **Violard.**

Les Territoires de l'Administration militaire de l'Extrême-Sud Tunisien. Par Émile Violard. *With Map and Illustrations.*

Uganda. **Dawe.**

Report on a Botanical Mission through the Forest Districts of Buddu and the Western and Nile Provinces of the Uganda Protectorate. By Mr. M. S. Dawe. London, 1906. Size 13 × 8½, pp. 64. *Map and Illustrations. Price* 1*s.* 5*d. Presented by the Author.*

Noticed in the September number, p. 291.

Uganda—Railway. **Kaiser.**

Die Uganda-Bahn in ihrem Einflusse auf die Eingeborenen. Von Alfred Kaiser. (Sonderabdruck aus den "Mitteilungen der Ostschweiz. Geograph.-Commerc. Gesellschaft" in St. Gallen.) Size 9 × 6, pp. 16. *Presented by the Author.*

West Africa. *La G., B.S.G. Paris* **13** (1906): 332–336. **Tilho.**

Délimitation franco-anglaise entre Niger et Tchad (Mission Moll). Par le Capitaine Tilho.

West Africa. *La G., B.S.G. Paris* **13** (1906): 244–247. **Chevalier.**

Une mission économique dans l'ouest Africain. Par Auguste Chevalier.

West Africa. *Globus* **89** (1906): 316–317. ———

Wo starb Friedrich Hornemann?

See note in the Monthly Record (*ante*, p. 509).

NORTH AMERICA.

Alaska. *National G. Mag.* **17** (1906): 69–82. **Gibbs.**
Transportation Methods in Alaska. By Captain G. S. Gibbs. *With Illustrations.*

Alaska. *B. American G.S.* **38** (1906): 145–167. **Tarr and Martin.**
Glaciers and Glaciation of Yakutat Bay, Alaska. By Ralph S. Tarr and Lawrence Martin. *With Map and Illustrations.*

Alaska—Yukon. *National G. Mag.* **17** (1906): 268–272. **Gibbs.**
The "Breaking up" of the Yukon. By Captain G. S. Gibbs. *With Illustrations.*

Aleutian Islands. **Egbert.**
Report on the Natural History of Kiska Island. By Dr. J. Hobart Egbert. (Reprinted from *Forest and Stream*, April 29, May 20, 1905.) Size 8 × 5, pp. 14. *With Illustration.*
The Flora and Fauna of Kiska Island. By the same. [Newspaper cutting.] *Presented by the Author.*

Canada. ———
Report of the Surveyor-General of Dominion Lands for the year ending June 30, 1904. Ottawa, 1905. Size 10 × 6½, pp. 334.

Canada—British Columbia. *Alpine J.* **23** (1906): 119–124. **Bainbridge.**
Six Weeks in the Lillouet District, B.C. By O. J. Bainbridge. *With Illustrations.*

Canada—Tides. **Dawson.**
Tide Levels and Datum Planes on the Pacific Coast of Canada. By Dr. W. Bell Dawson. (Supplement No. 1 to the Thirty-Eighth Annual Report of the Department of Marine and Fisheries.) Ottawa, 1906. Size 10 × 6½, pp. 22.
Referred to in the Monthly Record (October, p. 402).

Lake Michigan. *J. Geology* **14** (1906): 134–137. **Case.**
A peculiar formation of Shore Ice. By E. C. Case. *With Illustrations.*

Newfoundland—Labrador. **MacGregor.**
Report of an Official Visit to the Coast of Labrador. By His Excellency the Governor of Newfoundland, during the month of August, 1905. 1906. Size 13½ × 8½, pp. 85.

North America—Currents. **Davidson.**
North-West Currents. The Inshore Eddy Current along the North-West Coast of America. (By George Davidson.) (From the Daily Commercial News of January 27, 1906.) Size 8½ × 5½, pp. [4]. *Presented by the Author.*

Rocky Mountains. *American J. Sc.* **21** (1906): 296–300. **Keyes.**
Orotaxial Significance of Certain Unconformities. By Charles R. Keyes. *With Diagrams.*

United States. *G.Z.* **12** (1906): 135–145. **Heiderich.**
Veränderungen in der Bevölkerung der Vereinigten Staaten von Nordamerika. Von H. Heiderich.

United States—Arizona. *J. Geology* **14** (1906): 138–146. **Atwood.**
Red Mountain, Arizona: a dissected volcanic cone. By W. W. Atwood. *With Illustrations.*

United States—Arizona. *Science* **23** (1906): 721–730. **McGee.**
Climatology of Tinajas Altas, Arizona: Preliminary Report. By W J McGee.

United States—California. *National G. Mag.* **17** (1906): 280–300. **Ransome and others.**
The Probable Cause of the San Francisco Earthquake. By F. L. Ransome.
The Record of the Great Earthquake, written in Washington by the Seismograph of the U.S. Weather Bureau. By Prof. C. F. Marvin.
The San Francisco Earthquake of April 18, 1906, as Recorded by the Coast and Geodetic Survey Magnetic Observatories. By L. A. Bauer and J. E. Burbank. *With Map and Illustrations.*

United States—Catskill Mountains. *J. Geology* **14** (1906): 113–121. **Rich.**
Local Glaciation in the Catskill Mountains. By J. L. Rich. *With Illustrations.*

United States—Censuses. *B. American G.S.* **38** (1906): 223–227. **Gannett.**
The Interdecennial State Census. By Henry Gannett.

United States—Colorado. **Fenneman.**

Geology of the Boulder District, Colorado. By N. M. Fenneman. (U.S. Geol. Survey, Bulletin 265 (1905), pp. 102.) *With Maps and Illustrations.*

United States—Flora. *National G. Mag.* **17** (1906): 179-201. **Fairchild.**

Our Plant Immigrants: an account of some of the results of the work of the Office of Seed and Plant Introduction of the Department of Agriculture, and of some of the problems in process of solution. By David Fairchild. *With Illustrations.*

United States—Flora. *Science* **23** (1906): 749-751. **White.**

The Northern Limit of the Papaw Tree. By C. A. White.

A further brief note appears in vol. **24** of the same periodical (p. 48).

United States—Irrigation. *B. American G.S.* **38** (1906): 209-223. **Blanchard.**

National Reclamation of Arid Lands. By C. J. Blanchard. *Map and Illustrations.*

United States—Levels. *B. American G.S.* **38** (1906): 227-230. ——

Precise Levels in the United States.

United States—Mineralogy. **Pratt.**

Corundum and its occurrence and distribution in the United States. By Joseph Hyde Pratt. (U.S. Geol. Survey, Bulletin No. 269.) Washington, 1906. Size 9 × 6, pp. 176. *Maps and Illustrations.*

United States—Minnesota. *B. American G.S.* **38** (1906): 168-177. **Griggs.**

The Buffalo River: an interesting meandering stream. By Robert F. Griggs. *With Diagram and Illustration.*

United States—New York. *Popular Sc. Monthly* **68** (1906): 387-397. **Tarr.**

Watkins Glen and other Gorges of the Finger Lake Region of Central New York. By Prof. Ralph S. Tarr. *With Maps and Illustrations.*

Discusses the origin of the striking morphology of this region.

United States—New York. **Veatch and Others.**

Underground Water Resources of Long Island, New York. By A. C. Veatch, C. S. Slichter, I. Bowman, W. O. Crosby, and R. E. Horton. (U.S. Geol. Survey, Professional Paper, No. 44.) Washington, 1906. Size 11½ × 9, pp. 394. *Maps and Illustrations. Presented by the U.S. Geol. Survey.*

United States—North-Eastern States. **Dale.**

Taconic Physiography. By T. Nelson Dale. (U.S. Geol. Survey, Bulletin No. 272 (1905), pp. 52.) *With Maps and Plates.*

United States—South-West. *J. Franklin I.* **161** (1906): 451-467. **Carter.**

The Plateau Country of the South-West and La Mesa Encantada (the Enchanted Mesa). By Prof. O. C. S. Carter. *With Illustrations.*

United States—Wisconsin. **Alden.**

The Drumlins of South-Eastern Wisconsin. (Preliminary Paper.) By William C. Alden. (U.S. Geol. Survey, Bulletin No. 373 (1905), pp. 46.) *Map and Illus.*

CENTRAL AND SOUTH AMERICA.

Bermuda Islands. *P.A. Nat. Sc. Philadelphia* **57**, 1905 (1906): 695-700. **Harshberger.**

The Plant Formations of the Bermuda Islands. By Dr. J. W. Harshberger.

Bolivia, etc. **Pinilla.**

Memoria que presenta el Ministro de Relaciones Exteriores y Culto Doctor Claudio Pinilla al Congreso ordinario de 1905. La Paz, 1905. Size 10½ × 7, pp. 216.

Discusses the relations of Bolivia with other South American states. The terms of the treaty of 1904 between Bolivia and Chile, one article of which defines the common boundary in detail, are printed in full.

Brazil—Flora. *B. Museu Gœldi* **4** (1906): 510-619. **Huber.**

Materines para a Flora Amazonica. VI. Plantas vasculares colligidas e observadas no baixo Ucayali e no Pampa del Sacramento, nos mezes de outubro e dezembro de 1898 pelo Dr. J. Huber. *With Illustrations.*

Brazil and Venezuela. **Tavera-Acosta.**

Rionegro. Por B. Tavera-Acosta. Ciudad-Bolivar (Venezuela), 1906. Size 8 × 6, pp. xii. and 150.

Chapters on the natives, extracted from a larger work.

Central America—Volcanoes. *Globus* **89** (1906): 318-319. **Krebs.**
Vulkanische Analogien im mittleren Amerika aus neuester Zeit. Von W. Krebs.

Chile—Meteorology.
República de Chile. Anuario del Servicio Meteorológico de la Direccion del Territorio Marítimo. Tomo Sesto, 1904. Valparaiso, 1905. Size 10¼ × 7½, pp. 390. *Diagrams. Presented by the Direccion del Territorio Marítimo, Valparaiso.*

Nicaragua. **Grossmann and Hamilton.**
Periodical Accounts, Moravian Missions **66** (1906): 354-363.
Extracts from the Diary of the Rev. Guido Grossmann, whilst making a tour of exploration and evangelization on the Wanks River and its Tributaries in Nicaragua. By Bishop J. Taylor Hamilton.

Panama Canal. *Mouvement G.* **23** (1906): 154 157, 169-171, 194-195.
Le canal interocéanique de Panama.

Peru—Cajamarca. **Santolalla**
B. Cuerpo de Ingenieros de Minas, Peru, No. 31 (1905): pp. 84.
Importancia Minera de la Provincia de Cajamarca. Por Fermin Málaga Santolalla. *With Map, Plan, and Illustrations.*

Peru—Callao. **Sutton, Bravo, and Adams.**
B. Cuerpo Ingen. Minas Perú, No. 33 (1905): pp. 58.
Informes sobre la Provincia Constitucional del Callao. Por C. W. Sutton, J. J. Bravo y J. I. Adams. *With Maps and Diagrams.*

AUSTRALASIA AND PACIFIC ISLANDS.

New South Wales. *Records Geol. Surv. New South Wales* **8** (1905): 108-152. **Andrews.**
The Geology of the New England Plateau, with special reference to the Granites of Northern New England. By E. C. Andrews. Parts ii. and iii. *With Illustration.*

New South Wales—Jenolan Caves. **Lambert.**
J. Manchester G.S. **21**, 1905 (1906): 128-139.
Marvels of the Subterranean World (the Jenolan Caves, N.S.W.). By F. Lambert. *With Illustrations.*

New Zealand. *J. Geology* **14** (1906): 22-54. **Andrews.**
The Ice-flood Hypothesis of the New Zealand Sound Basins. By E. C. Andrews. *With Illustrations.*

New Zealand—Mount Cook. *Alpine J.* **23** (1906): 124-140. **Ross.**
The First Crossing of Mount Cook. By Malcolm Ross. *With Illustrations.*

Pacific Islands. *B. Musée Océanograph. Monaco*, No. 75 (1906): pp. 24. **Seurat.**
Cours d'Océanographie fondé a Paris par S.A.S. le Prince Albert de Monaco (Deuxième Année). Le Nacre et la Perle en Océanie. Pêche. Origine et mode de formation des perles. Par L. G. Seurat. *With Illustrations.*

Queensland. *Minutes of P.I. Civil Engineers* **163** (1906): 289-299. **Bellamy.**
On the Rainfall of Central Queensland and Floods in the Fitzroy River. By H. E. Bellamy. *With Maps and Sections.*

Samoa—Savaii. *Deutsches Kolonialblatt.* **17** (1906): 17-18. **Linke.**
Besichtigung des auf der Insel Savaii im Sommer 1905 neu entstandenen Vulkans, ausgeführt von Dr. T. Linke.

Western Australia. **Campbell.**
The Geology and Mineral Resources of the Norseman District, Dundas Goldfield. By W. D. Campbell. (Western Australia, Geological Survey, Bulletin No. 21.) Perth, 1906. Size 8½ × 5½, pp. 140. *Maps and Illustrations.*

POLAR REGIONS.

Antarctic—South Victoria Land. **Ferrar.**
Rep. Brit. Ass., South Africa, 1905 (1906): 396-397.
On the Geology of South Victoria Land. By H. T. Ferrar.

Arctic—Norwegian Expedition. **Simmons.**
Report of the Second Norwegian Arctic Expedition in the *Fram*, 1898-1902.

No. 2. The Vascular Plants in the Flora of Ellesmere Land. By H. G. Simmons. Kristiania, 1906. Size 10 × 7, pp. 198. *Map and Plates. Presented by the Author.*

The author has made a careful study of all the collections brought home by other voyagers, in addition to those collected by himself (see *ante*, p. 513).

Arctic—Wellman Expedition. *National G. Mag.* **17** (1906): 206–228. **Wellman.**

Walter Wellman's Expedition to the North Pole. The Polar Airship. By Walter Wellman. *With Diagrams. Also separate copy, presented by the author.*

Noticed in the June number (p. 635).

Greenland. *Ann. de G.* **15** (1906): 59–69. **Engell.**

La région de Jakobshavn (Groenland). Par M. C. Engell.

Greenland. *Petermanns M.* **52** (1906): 45–46. **Mylius-Erichsen.**

Plan der "Danmark"-Expedition nach der Nordostküste von Grönland, Juni 1906 bis Sept. 1908. Von L. Mylius-Erichsen.

MATHEMATICAL GEOGRAPHY.

Cartography—Polar Regions. *B. American G.S.* **38** (1906): 126–128. **Abbe.**

A Modified Polar Projection adapted to studies in Dynamic Meteorology. By Cleveland Abbe. *With Sketch-maps.*

Geodesy. **Albrecht and Wanach.**

Centralbureau der Internationalen Erdmessung: Neue Folge der Veröffentlichungen, No. 13. Resultate des Internationalen Breitendienstes. Band ii. Von Th. Albrecht und B. Wanach. Berlin, 1906. Size 11½ × 9, pp. 190. *Diagrams.*

Instruments. **Seidel and Miller.**

Instrumentenkunde für Forschungs-Reisende. Unter Mitwirkung von Ingenieur C. Seidel, bearbeitet von W. Miller. Hannover: Dr. Max Jänecke, 1906. Size 10 × 7, pp. viii. and 200. *Illustrations. Presented by the Publisher.*

Reviewed elsewhere in the *Journal* (October, p. 394).

Rotation. *Met. Z.* **23** (1906): 200–209. **Grossmann.**

Die horizontale Komponente der ablenkenden Kraft der Erdrotation. Eine Ehrenrettung des Hadley-Doveschen Prinzips. Von Prof. Grossmann.

Surveying. **Vallot.**

Manuel de Topographie Alpine. Par Henri Vallot. Paris: H. Barrère, 1904. Size 7 × 4⅓, pp. xiv. and 172. *Price* 2*s.* 8*d.*

A useful guide to surveying in mountain regions.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Denudation. *J. Geology* **14** (1906): 91–119. **Andersson.**

Solifluction, a component of Subaërial Denudation. By J. G. Andersson. *With Illustrations.*

The author brings together his personal observations on special forms of the removal of waste by the action of gravity in the polar regions.

Earth-movements. *American J. of Sc.* **21** (1906): 216–220. **Fisher.**

A Suggested Cause of Changes of Level in the Earth's Crust. By Rev. O. Fisher.

The cause in question is the existence of ascending and descending currents, due to cooling, in a supposed liquid substratum.

Geological History. *J. Geology* **14** (1906): 81–90. **Schwarz.**

The Former Land Connection between Africa and South America. By E. H. L. Schwarz.

Discusses the various kinds of evidence in support of such a connection, including that supplied by Oceanic islands (cf. *Journal*, vol. 26, p. 458).

Geomorphology. *B. American G.S.* **38** (1906): 89–91. **Fenneman.**

Floodplains produced without Floods. By N. M. Fenneman.

Geomorphology. *American J. Sc.* **21** (1906): 261–269. **Hilgard.**

Some Peculiarities of Rock-weathering and Soil Formation in the Arid and Humid Regions. By E. W. Hilgard.

Geomorphology. *Petermanns M.* **52** (1906): 38–40. **Tronnier.**

Die Veränderungen der Erdoberfläche. Ein Mahnwort von Oberlehrer Richard Tronnier.

Hydrology. *C. Rd.* **142** (1906): 1113–1115. **Dienert.**

De la minéralisation des eaux souterraines et des causes de sa variation. Note de F. Dienert.

Meteorology. *Arkiv för Matematik, etc.* **2** (1905–06): No. 26, pp. 24. **Westman**

Beobachtungsergebnisse von sechs Ballonfahrten der Schwedischen Aeronautischen Gesellschaft. Zusammengestellt von J. Westman. *With Maps.*

Meteorology—Aurora. **Kuznetzoff.**

B.A. Imp. Sc. St. Petersburg **21** (1904): *Classe phys.-math.*, 141–149.

Détermination de la hauteur des rayons d'aurores boréales. Par V. Kousnetzow. *With Diagrams.*

Meteorology—Aurora. **Paulsen.**

Oversigt K. Danske Videnskabernes S. Forhandlinger (1906): 109–144.

Sur les récentes théories de l'aurore polaire. Résumé et critique des théories de MM. Birkeland, Arrhenius et Nordmann. Idées personelles. Par Adam Paulsen. *With Plate.*

Meteorology—Trade-winds. *B. American G.S.* **38** (1906): 128–130. **Rotch.**

Proof of the existence of the Upper Anti-Trade and the Meteorological Conditions at Lesser Heights in the Northern Tropics. By A. Lawrence Rotch.

Meteorology—Winds. **Shaw and Lempfert.**

The Life History of Surface Air-currents. A Study of the Surface Trajectories of Moving Air. By W. N. Shaw and R. G. K. Lempfert. London, 1906. Size 12 × 10, pp. 108. *Charts, Diagrams, etc. Price 7s. 6d. Presented by the Meteorological Office.*

Meteorology—Winds. **Teisserenc de Bort.**

Sur la Circulation générale de l'atmosphère. Relations entre la température et la pression de l'air à la surface du globe et dans l'atmosphère libre. Par Léon Teisserenc de Bort. (*Meteorologische Zeitschrift*, Hann-Band, pp. 216–228.) Braunschweig: F. Vieweg und Sohn, 1906. Size 12 × 8. *Diagrams.*

Meteorology—Winds—Historical. **Günther and Dannbeck.**

Sitzb. K.B.A.W. München, 1905 (1906): 381–426.

Die Vorgeschichte des barischen Windgesetzes. Von S. Günther und S. Dannbeck. *With Diagrams.*

Oceanography. *B.S.G. Italiana* **7** (1906): 322–338. **Almagià.**

Il primo scritto italiano di Oceanografia. Nota del dott. R. Almagià.

Refers to the 'Relatione del mare' of Giovanni Botero (end of sixteenth century).

Oceanography. **Berget.**

Cours d'Océanographie fondé à Paris par S.A.S. le Prince de Monaco (Deuxième Année.) Phénomènes d'Interférences: Seiches. Par A. Berget. (Bull. Musée Océanographique de Monaco, No. 61 (1906), pp. 18.) *With Diagrams.*

Oceanography. **Monaco.**

Sur la septième campagne scientifique de la Princesse Alice. Note de S.A.S. le Prince Albert de Monaco. (Bull. Musée Océanographique de Monaco, No. 69 (1906), pp. 6.)

Oceanography. **Dautzenberg and Fischer.**

Résultats des Campagnes Scientifiques accomplies sur son yacht, par Albert Ier Prince Souverain de Monaco. Fasc. xxxiii. Mollusques provenant des dragues effectués à l'ouest de l'Afrique pendant les campagnes scientifiques de S. A. S. le Prince de Monaco. Par Ph. Dautzenberg et H. H. Fischer. Monaco, 1906. Size 14 × 11½, pp. 126. *Plates.*

Oceanography. *B. Musée Océanograph. Monaco*, No. 74 (1906): pp. 26. **Joubin.**

Cours d'Océanographie fondé à Paris par S. A. S. le Prince de Monaco (Deuxième Année). La répartition des animaux marins sur les côtes françaises de la Méditerranée. Par L. Joubin. *With Maps and Illustrations.*

Oceanography. *Z. Ges. E. Berlin* (1906): 347–355. ———

Das Institut und Museum für Meereskunde an der Universität Berlin.

Oceanography—Black Sea. **Zernoff.**
B.A. Imp. Sc. St. Petersburg **20** (1904): *Classe phys.-math.*, 119–134.
Sur le changement annuel du plancton de la mer Noire dans la baie de Sébastopol. Par S. Zernov. *With Diagrams.* [In Russian.]

Oceanography—Deposits. *C. Rd.* **142** (1906): 738–739. **Thoulet.**
Le calcaire et l'argile dans les fonds marins. Note de J. Thoulet.

Oceanography—Plankton. **Nathansohn.**
B. Musée Océanographique Monaco, No. 62 (1906): pp. 12.
Sur l'influence de la circulation verticale des eaux sur la production du Plankton marin. Par A. Nathansohn.

Phytogeography. *G Z.* **12** (1906): 79–92, 145–155. **Karsten.**
Bericht über die Fortschritte der Pflanzengeographie in den Jahren 1899–1904. Von Karsten.

Sand. **Drabble and Thompson.**
Quarterly J.I. Com. Research in the Tropics, Liverpool University **1** (1906): 82–89.
On the effect of organic matter on the water-holding capacity of sands. By Dr. E. Drabble and Dr. K. J. Thompson.

Seismology. *P.R.S.*, Ser. A, **77** (1906): 365–376. **Milne.**
Recent Advances in Seismology. By John Milne, F.R.S. *With Diagrams.*

Seismology. *Ann. de G.* **15** (1906): 1–8. **Montessus de Ballore.**
Les Tremblements de Terre et les systèmes de déformation tetraédrique de l'écorce terrestre. Par F. de Montessus de Ballore.

Seismology. *M.G. Ges. München* **1** (1906): 625–635. **Günther.**
Ein Kulturhistorischer Beitrag zur Erdbebenlehre. Von S. Günther.

Terrestrial Magnetism. **Heimbrod.**
Results of Harmonic Analysis of the Diurnal Variation at the Cape of Good Hope and at Hobart. By E. Heimbrod. Part ii. Horizontal and vertical Intensities. (From *Terrestrial Magnetism and Atmospheric Electricity* for September, 1905.) Size 10 × 7, pp. [11]. *Presented by the Author.*

Tides. *M.V. Erdk. Dresden* (1906): 3–37. **Abendroth.**
Entwickelung und gegenwärtiger Stand der Gezeitenforschung. Von W. Abendroth.

Volcanoes. **Reclus.**
Les Volcans de la Terre. Par Élisée Reclus. Ier Fasc. [Bruxelles]: Société Belge d'Astronomie, 1905. Size 10 × 6½, pp. 168. *Presented by the Institut géographique Élisée Reclus.*

Waves. **Forchheimer.**
Wasserbewegung in Wanderwellen. Von Prof. Dr. Philipp Torchheimer. (Sonder-Abdruck aus Zeitschrift für Gewässerkunde, 6 Band, Heft 6.) Size 10 × 7, pp. [19]. *Illustrations and Diagrams. Presented by the Author.*

Zoogeography. **Gough.**
On the Distribution and the Migrations of *Muggiæa Atlantica*, Cunningham, in the English Channel, the Irish Sea, and off the South and West Coasts of Ireland, in 1904. By Lewis Henry Gough. (Conseil Permanent International pour l'Exploration de la Mer: Publications de Circonstance, No. 29.) Copenhagen, 1905. Size 10 × 7, pp. 14. *Charts.*

Zoogeography. *G.Z.* **12** (1906): 212–222. **Arldt.**
Die tiergeographischen Reiche und Regionen. Von T. Arldt.

Zoogeography—Horse. *P.R.S. Edinburgh* **26** (1906): 7–21. **Ewart.**
The Tarpan and its Relationship with Wild and Domestic Horses. By Dr. J. C. Ewart. *With Illustrations.*

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Commercial—Pacific Ocean. *Izvestia Imp. Russ. G.S.* **40** (1904): 481–556. **Woeikoff.**
Will the Pacific Ocean be the chief commercial Highway of the World? By A. I. Woeikoff. [In Russian.] *With Map.*

Historical—Columbus and Toscanelli. **Vignaud.**
Bibliografia della polemica concernante Paolo Toscanelli e Cristoforo Colombo

originata dalle comunicazioni di Gonzalez de la Rosa e di Enrico Vignaud al Congresso degli Americanisti tenuto o Parigi nel settembre del 1900. Saggio compilato da Enrico Vignaud, tradotto con Introduzione e aggiunte da Gustavo Uzielli. Napoli, 1905. Size 10½ × 7½, pp. 36. *Presented by the Author.*

History of Cartography. *B.R.S.G. Madrid* **48** (1906): 190–237. **Blazquez.**

Estudio acerca de la cartografia española en la Edad media. Por A. Blazquez. *With Facsimile Maps.*

BIOGRAPHY.

Barton.

Alfred Bowyer Barton, M.D., F.R.C.S., F.R.G.S. Memoir and extracts from his diary. A Fragment. London: Printed for Private Circulation, 1906. Size 7½ × 5, pp. 154. *Presented by Mrs. Barton.*

Dr. Barton is best known to geographers as the companion of Colonel Sarel and Captain Blakiston during the ascent of the Yangtse in 1861. He died in July, 1905.

Beltrame. *B.S.G. Italiana* **7** (1906): 487–490. **Biadego.**

Don Giovanni Beltrame, necrologia di G. Biadego.

Mushketoff. *Izvestia Imp. Russ. G.S.* **38** (1902): 629–644. **Bogdanovitch.**

The influence of the scientific works of I. V. Mushketoff on the increase of geographical knowledge of Asia. By K. I. Bogdanovitch. [In Russian.]

Richthofen—Bibliography. **Tiessen.**

Die Schriften Ferdinand Freiherr von Richthofens. Zusammengestellt von Dr. E. Tiessen. (Separatabdruck aus "Männer der Wissenschaft," Heft 4: Ferdinand Freiherr von Richthofen. Gedächtnisrede von Prof. Dr. E. von Drygalski.) Leipzig, 1906. Size 9 × 6, pp. 18. *Presented by Frau F. von Richthofen.*

GENERAL.

Bibliography. **Baschin.**

Bibliotheca Geographica. Herausgegeben von der Gesellschaft für Erdkunde zu Berlin. Bearbeitet von Otto Baschin. Band xi. 1902. Berlin: W. H. Kühl, 1905. Size 9½ × 6, pp. xvi. and 532. *Presented by the Gesellschaft für Erdkunde, Berlin.*

This volume includes over 10,000 titles, and the periodicals dealt with number about 1000, so that the work may well claim to be the most complete geographical bibliography in existence.

Bibliography.

Katalog I. enthaltend wertvolle und seltene Bucher und Manuscripte jeder Art, Handzeichnungen, u.s.w. Vorraetig bei Martin Breslauer, Buchhaendler und Antiquar in Berlin. Size 9 × 6, pp. viii. and 236. *Facsimile Illustrations, etc. Price 4 marks. Presented by the Compiler.*

Includes a number of raritics from the early days of printing, a few being of geographical interest.

Climate and Disease. *P.R. Irish A.* **26** (1906): *Section B.*, 46–49. **Marsden.**

Sixteen Years' Observations on the relation between temperature and rainfall and the spread of Scarlatina, Measles, and Typhoid Fever. By R. Sydney Marsden, D.Sc.

Educational. **Burrows.**

Geographical Gleanings. Part i. "On Some Methods of Teaching Geography." Part ii. "On the Preparation and Teaching of the Subject." By the Rev. F. R. Burrows. London: G. Philip & Son, 1906. Size 9 × 6, pp. 76. *Price* 1*s.* 6*d. net. Presented by the Publishers.*

Educational. *J. Manchester G.S.* **21**, 1905 (1906): 104–112. **Martin.**

Geography in Schools. By H. C. Martin.

French Colonies—Statistics.

Ministère des Colonies: Office Colonial. Statistiques Coloniales pour l'année 1903. Publiées sous l'administration de M. Clémentel. Navigation-Melun, 1905. Size 9½ × 6, pp. 152.

Geography. *J.G.* **5** (1906): 145–160. **Davis.**

An Inductive Study of the Content of Geography. By W. M. Davis.

Noticed in the August number (p. 184).

Place-names. **Knox.**

Rules for the Transliteration of Place-names occurring on Foreign Maps. Compiled by A. Knox. 1905. London: Printed by Harrison & Sons, 1905. Size 6½ × 4½, pp. iv. and 82.

These rules are drawn up for use in the War Office, Intelligence Division. The R.G.S. system of spelling is not altered, but guidance is given as to the way in which it is to be applied in transliteration from foreign systems.

Year-Book. **Wagner.**

Geographisches Jahrbuch . . . xxviii. Band, 1905 . . . herausgegeben von Hermann Wagner. Zweite kleinere Hälfte. Gotha, 1906. Size 9 × 6, pp. 289–456 and x. *Price* 6 *marks.*

Deals with recent progress in magnetism, and the various methods of determining position.

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

England and Wales. **Ordnance Survey.**

Sheets published by the Director-General of the Ordnance Survey, Southampton, from September 1 to 30, 1906.

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25-inch—County Maps (first revision):—

Carmarthenshire, XL. 16; XLI. 13, 14, 15; XLII. 13, 14, 15; XLVII. 4, 6, 10, 11; XLIX. 4. **Cornwall,** I. 8, 15; III. 3, 4, 8, 15; IV. 1, 2, 5, 6, 9, 10, 13; V. 4, 8, 12; VI. 1, 2, 9, 13, 14; VIII. 3, 7, 9, 11, 14, 15; XI. 2, 7, 8, 11, 12, 14, 15 (16 and IX*a.* 13); XI. 1, 2, 3, 4, 5, 6, 7, 8, 9, 15, 16; XII. 3, 4, 9, 13, 14, 15, 16; XV. 1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 12; XVI. 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 16; XVII. 1, 5, 6, 9, 10, 13, 14; XXII. 2, 3, 4, 6, 10, 11, 12, 14, 15; XXIII. 1, 5, 9, 10, 13, 14; XXVIII. 2, 4; XXIX. 2. 3*s. each.* II. 10; IV. 3, 7; VI. (6 and 10) 16; XII. 8, 10 (7, 2, and 5); XII*a.* 13; XXIII. 3. 1*s.* 6*d. each.* **Devonshire,** XXXVIII. 7, 8, 12; XLIX. 4, 8, 12, 15; LXI. 2, 7, 12; LXII. 9, 13; LXXIII. 14; LXXIV. 1, 10, 13; LXXXV. 2, 3, 4, 8; LXXXVI. 1, 2, 3, 4, 5, 6, 7, 8, 11, 12, 16; XCVI. 4, 12; CXI. 8, 11; CXVII. 3, 7, 11. 3*s. each.* XXXVIII. 11; XLIX. 7, 11, 3; LXXIII. (6 and 5), 7, 9, 12, 13; LXXIV. 5, 9; LXXXV. (7 and 6); LXXXVI. 9, 10. 1*s.* 6*d. each.* **Lincolnshire,** XLII. 8; XLIV. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16; XLV. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16; XLVI. 1, 2,

3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16; XLVII. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15; XLVIII. 2, 3, 4, 6, 9, 11, 12, 14, 15, 16; LVI. 11. **Merionethshire,** XX. 16; XXI. 1, 5, 9, 13. **Norfolk,** XIX. 8, 9, 11, 15, 16; XX. 13, 14, 15; XXVII. 4; XXVIII. 4, 8, 12, 16; XXIX. 1, 2, 3, 4, 7, 8, 13, 14, 16; XXX. 9, 10, 11, 13, 14, 16; XXXI. 16; XLIII. 3, 4, 7; LV. 4; LXXXVII. 6, 11, 14, 15. **Yorkshire (First Revision of 1891 Survey),** CCLIII. 1, 11; CCLX. 6, 8, 12; CCLXI. 1, 4, 6, 14, 16. *3s. each.*

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England and Wales. **Geological Survey.**

Map of the British Islands. Scale 25 miles to 1 inch. Showing the sheets on the Four-Mile and One-Inch Scales, with particulars of Memoirs, Maps, Sections, etc., printed on back. *Price* 1*s.*

1-inch—New Series (colour printed).

Macclesfield, 110; Isles of Scilly, 357 and 360. *Price* 1*s. each.*

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France. **Ministre de l'Interior, Paris.**

Carte de la France dressée par ordre der Ministre de l'Intérieur. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheets: XIX.–16, Aix-en-Othe; XXIV.–25, Aunecy. Paris: Ministère de l'Intérieur, Service Vicinal, 1906. *Price* 0.80 *fr. each sheet.*

Germany. **Dan.**

Deutsches Reich. Uebersichtskarte der relativen Verbreitung der Berufsgruppe: Chemische Industrie nach der Zählung vom 14 Juni 1895. Von Dr. Walter Dan. Scale 1 : 3,700,000 or 1 inch to 58·4 stat. miles. *Petermanns Mitteilungen,* Jahrgang 1906, Tafel 14. Gotha: Justus Perthes, 1906. *Presented by the Publisher.*

Germany. **K. Preussische Landesaufnahme.**

Karte des Deutschen Reiches. Herausgegeben von der Kartogr. Abteilung der Kgl. Preuss Landesaufnahme. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheet: 366, Torgau. Berlin: K. Preussische Landesaufnahme, 1906. *Price* 1.50*m. each sheet.*

ASIA.

China. **Topographical Section, General Staff.**

Province of Shan-tung. Compiled in the Topographical Section, General Staff. Scale 1 : 1,000,000 or 1 inch to 15·8 stat. miles. London: Topographical Section, General Staff, War Office, 1905. *Price* 2*s.* 6*d. Presented by the Director of Military Operations.*

A useful map of the province of Shantung compiled from all the most reliable route sketches and surveys up to date, a list of which is given on the map. It is clearly executed and printed in colours.

India. **Eliot.**

Climatological Atlas of India. Published by the authority of the Government of India under the direction of Sir John Eliot, K.C.I.E., F.R.S., late Meteorological Reporter to the Government of India, and Director-General of Indian Observations. Issued by the Indian Meteorological Department, 1906. *Price per copy, 27 rupees in India and* 36*s. in the United Kingdom. Presented by the Secretary of State for India.*

This atlas will be specially noticed.

Yunnan. **Davies.**

Map of Yün-nan. Scale 1 : 1,267,200 or 1 inch to 20 stat. miles. Compiled by Major H. R. Davies. London: Topographical Section, General Staff, War Office, 1906. *Price* 3*s.* 6*d. Presented by the Director of Military Operations.*

The remarkable progress in the exploration and survey of South-West China in recent years will be clearly seen by a comparison of this map with one of thirty years ago, when Mr. E. C. Baber and Captain W. J. Gill made their famous journeys through these regions. At that time, with the exception of the excellent route surveys by these two explorers, practically nothing but the roughest sketches of the region existed; now, however, a great deal of really good work has been done, both by British and French officers and explorers, of which Major H. R. Davies has taken full advantage in the compilation of this excellent map. The map has been drawn under Major H. R. Davies' personal supervision and direction from the Survey of India sheets on 4 miles to an inch, which, besides the standard sheets of Burma and the frontier, include the extensive surveys by Major Davies himself in 1895 and 1898–1900, together

with those of Captain C. H. D. Ryder, Captain E. C. Pottinger, Captain W. A. Watts-Jones, Captain C. G. W. Hunter, and many others whose names are mentioned on the maps, as are also those of other travellers from whose work additions and corrections have been made which are not included on the Survey of India sheets. Although the title states that this is a map of Yünnan, the area embraced is considerably greater, and extends from lat. 21° to 30° 15′ N., and from long. 97° to 106° E. The map measures 29 by 33 inches, and is printed in colours.

AFRICA.

Egypt. **Egyptian Survey Department.**

Provisional map of a portion of the Eastern Desert of Egypt. Scale 1 : 1,000,000 or 1 inch to 15·8 stat. miles. Sheets: 12 G, 13 E, 13 F, 14 F, 14 G. Giza: Survey Department, 1906. *Presented by the Director-General, Survey Department, Giza.*

Additional sheets of the map referred to in the last number of the *Geographical Journal*. They include the greater part of the region extending from lat. 24° 25′ to 25° 35′ N., and long. 33° to 34° 30′ E., and, like the others, are only provisional issues not finally adjusted to the points fixed by triangulation.

Egypt. **Egyptian Survey Department.**

Topographical map of Giza Province. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheet: N.E., 4-5. Giza: Survey Department, 1905. *Presented by the Director-General, Survey Department, Giza.*

AMERICA.

Canada. **Department of the Interior.**

Sectional map of Canada. Scale 1 : 190,080 or 1 inch to 3 stat. miles. Sheets: 71, Brandon, revised to July 16, 1906; 72, Portage en Prairie, revised to July 16, 1906; 74, Croso Lake, revised to August 7, 1906. Ottawa: Department of the Interior, Topographical Surveys Branch, 1906. *Presented by the Canadian Department of the Interior.*

Rio de Janeiro. **Greiner.**

Planta da Cidade do Rio de Janeiro e Suburbios organisado e desenhado pelo Engr Ulrik Greiner. Scale 1 : 12,500 or 5·06 inches to 1 stat. mile. Rio de Janeiro: Laemmert & Co.

GENERAL.

Ancient Atlas. **Kiepert.**

Formae Orbis Antiqui. 36 Karten in Format von 52 : 64 cm. mit kritischem Text und Quellenangabe zu jeder Karte. No. xiii. Peloponnesus cum Attica. Mit 6 Seiten Text. No. xiv. Phocis, Bœotia, Attica, Athenæ, mit 8 Seiten Text. Bearbeitet und herausgegeben von Richard Kiepert. Berlin: Dietrich Reimer (Ernest Vohsen), 1906. *Price 3m. each sheet.*

Of the thirty-six maps, of which this atlas will consist, only fourteen are yet published, including the two mentioned above, although the first appeared twelve years ago. The style in which they are produced is extremely good, and each map is accompanied by explanatory and critical text, giving also the sources of information.

World. **Bartholomew.**

Atlas of the World's Commerce. A new series of maps, with descriptive text and diagrams, showing products, imports, exports, commercial conditions, and economic statistics of the countries of the world. Compiled from the latest official returns at the Edinburgh Geographical Institute, and edited by J. G. Bartholomew, F.R.G.S., F.R.S.E. Part x. London: George Newnes, Limited, [1904] *Price 6d. each part. Presented by the Publisher.*

This part is of exceptional interest, and contains, in addition to smaller charts and diagrams, two general commercial maps, one of Europe and the Near East, and the other of the Far East, which includes the whole of Asia from Tobolsk to the Indian ocean, and from the Aral sea to the Pacific ocean. Each of these maps is coloured to show vegetation, in addition to which principal railways, canals, navigable rivers, telegraphs, British consular stations, and other information of a commercial character are given. There is the usual continuation of the alphabetical list of commodities of commerce, and a most instructive diagram showing the relative values and importance of the imports and exports of the United Kingdom in the year 1905.

World. **Stieler.**

Neunten, von Grund aus neubearbeiteten und neugestochenen Auflage von Stielers

Hand Atlas 100 Karten auf 200 Seiten mit 162 Nebenkarten in Kupferstich und einem alphabetischen Verzeichnis aller im Atlas vorkommenden Namen (ungefähr 240,000 Namen enthaltend) herausgegeben von Justus Perthes' Geographischer Anstalt in Gotha. Lieferungen 19, 20, 21 und 22. Gotha: Justus Perthes, 1906. *Price 60 pf. each part.*

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during August, 1906. *Presented by the Hydrographer, Admiralty.*

No.	Inches.	
1914 m	= 17·8	England, south coast:—Looe harbour. 2*s.*
3563 m	= 1·41	Norway, western approaches to Vigten islands:—Gineslingerne light to Kalvö. 3*s.*
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3599 m	= 4·0	Plans and anchorages in the Persian Gulf. Henjam island anchorage. 2*s.*
3586 m	= 1·2	Malacca strait, Sumatra, north-east coast. Aru bay. 2*s.*
3577 m	= 0·5	Borneo island:—Sesajap and Bulungan rivers. 3*s.*
3548 m	= 1·8	Japan:—Yokohama to Uraga. 3*s.*

New Plans and Plans added.

1304 m	= 1·08 2·35 2·35	Plans on the coast of Chile. New plan:—Tictoc bay. Plans added:—Port Auchemo, Port Velcho
1508 m	= 7·1	Anchorages in the New Hebrides islands. Plans added:—Betarara anchorage.

(*J. D. Potter, Agent.*)

Charts Cancelled.

No.		Cancelled by	No.
1914	England, south coast: Looe harbour.	New chart. Looe harbour	1914
3344	San Domingo:—Monte Cristi bay and approaches.	New Chart. For Liberté, Manzanil'o, and Monte Cristi bays	3344
471	San Domingo:—Manzanillo bay.		

(*J. D. Potter, Agent.*)

Charts that have received Important Corrections.

No. 1607, England, east coast:—River Thames, North Foreland to the Nore. 847, Cyprus:—Famagusta and Salamis, Famagusta harbour. 2478, Africa, west coast:—Manna river to Junk river. 7, Gulf of Aden:—Aden and adjacent bays. 2195, Celebes sea:—Plans in east part of Celebes. 976, Philippine islands:—Manila bay. 1798, China, north coast:—Kwang tung peninsula, including Ta lien kwan and the approaches to Port Arthur. 1270, Korea:—Approaches to Chemulpo anchorage.

(*J. D. Potter, Agent.*)

Chile. **Chilian Hydrographic Office.**

Chilian Hydrographic Charts. Nos.: 116, Puertos de las Islas Guaitecas; 135, Tierra del Fuego. Bahia allen Gardner, Seno Tekenica. Valparaiso: Oficiana Hidrografica, 1906. *Presented by the Chilian Hydrographic Office.*

Indian Ocean and Red Sea. **Meteorological Office.**

Meteorological Chart of the Indian Ocean north of 15° S. lat., and Red Sea for

October, 1906. London: Meteorological Office, 1906. *Price* 6*d*. *Presented by the Meteorological Office.*

North Atlantic. **U.S. Hydrographic Office.**

Pilot Chart of the North Atlantic Ocean for Washington, 1906. Washington: U.S. Hydrographic Office, 1906. *Presented by the U.S. Hydrographic Office.*

North Atlantic and Mediterranean. **Meteorological Office.**

Meteorological Chart of the North Atlantic and Mediterranean for October, 1906. London: Meteorological Office, 1906. *Price* 6*d*. *Presented by the Meteorological Office.*

North Pacific. **U.S. Hydrographic Office.**

Pilot Chart of the North Pacific Ocean for October, 1906. Washington: U.S. Hydrographic Office, 1906. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Northern Nigeria. **Home.**

Fifty photographs of Northern Nigeria, taken by Douglas R. Home, Esq. *Presented by Douglas R. Home, Esq.*

A set of quarter-plate silver prints. As will be seen from the titles, some of the subjects, such as native salt-fields, smelting furnaces, markets, and others, are of special interest.

(1) The High Commissioner's yacht on the Niger near Lokoja; (2) Typical bungalow as provided for European officers, Lokoja; (3) Road to the native market, Lokoja; (4 and 5) In Lokoja market; (6) The Wase rock; (7) Part of our column crossing the sands bordering on the river Benue; (8) Crossing the Ankwe river; (9) A halt on the banks of the Ankwe river; (10 and 11) Native salt-fields, Azara; (12) Native Hausa salt-fields, Akiri; (13) Making camp outside Awe; (14) Landing at Ibi; (15) Embarking at Ibi; (16 and 17) In the market at Ibi; (18) Clearing ground for camp Okeli; (19) Outside the king's house at Little Eboni; (20) Native bridge, Kabba Province; (21) Kukuruku country; (22) Northern Nigeria police at Dekina; (23) Two sections of B Company, 2nd Batt. Northern Nigeria Regiment, Dekina; (24) Good-bye, Dekina; (25) Starting the carriers, Dekina; (26) In the village of Aguatcha; (27) Stream in the town of Bida; (28) The exterior of the Emir of Bida's compound; (29 and 30) Lampai; (31 and 32) Types of Nupes, Lampai; (33) Inside view of roof of native Nupe house; (34) The Niger Company's compound near Tilde; (35–37) Native iron smelting furnaces, Panguru; (38) In the Joss country; (39) Stern-wheeler, "Karonga," river Benue; (40) A political officer and staff; (41) Some of the officers of the Munshee Expedition; (42) Native soldiers saying good-bye to their wives at Lokoja, Munshee Expedition; (43) Men of the 2nd Batt. marching down to the Niger for embarkation, Munshee Expedition; (44) Embarking men and stores of 2nd Batt., Lokoja, Munshee Expedition; (45) The first section embarked off Lokaja, Munshee Expedition; (46) Hausa fiddler and Yoruba headman; (47) Hausa boy; (48 and 49) Pelicans on the Niger.

Vegetation Types. **Karsten and Schenck.**

Vegetationsbilder herausgegeben von Dr. G. Karsten und Dr. H Schenck. Vierte Reihe, Heft 2. Das südliche Togo. Von Dr. Walter Busse. Jena: Gustav Fischer, 1906. *Price* 2.50*m. each part.*

Yorkshire **Wigram.**

Three Photographs of the Obelisks known as the "Devil's Arrows" at Boroughbridge, Yorkshire, taken by Major H. H. Wigram, late Scots Guards. *Presented by Major H. H. Wigram.*

These obelisks consist of three rude masses of millstone grit, and are situated about a quarter of a mile from Boroughbridge, on the Wetherby road. They stand N.–S., the northern stone being about 129 feet from the central one, which is 360 feet from the southern. They are 18 to 22½ feet in height, and there was formerly a fourth stone. In spite of many conjectures, little or nothing is known as to the origin of these remarkable pillars.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.